Editor
CHARLES O. HERB

Associate Editors
FREEMAN C. DUSTON
CHARLES H. WICK

Book Editor
HOLBROOK L. HORTON

•

Published Monthly By
THE INDUSTRIAL PRESS
49 Lafayette St., New York 13, N. Y.

ROBERT B. LUCHARS
President

EDGAR A. BECKER
Vice-President and Treasurer

HAROLD L. GRAY
Secretary and Publishing Manager

•

Advertising Representatives
WALTER E. ROBINSON
DWIGHT COOK
49 Lafayette St., New York 13, N. Y.

GEORGE H. BUEHLER
228 N. LaSalle St., Chicago 1, Ill.

NORMAN O. WYNKOOP, Jr.
568 Maccabees Bldg., Detroit 2, Mich.

DON HARWAY & COMPANY
1709 W. Eighth St., Los Angeles 17, Calif.

Subscription Rates: United States and Canada, one year, $4; two years, $7; three years, $8; foreign countries, one year, $7; two years, $13. Single copies 40 cents. Changes in address must be received by the fifteenth of the month to be effective for the next issue. Send old as well as new address. Copyright 1952 by The Industrial Press. Entered as second-class mail matter, September, 1894, at the Post Office, New York, N. Y., under the Act of March 3, 1879. Printed in the United States of America.

British Address:
National House, West St.
Brighton 1, England

Total Distribution
for February, 24,635

MACHINERY

VOLUME 58 MARCH, 1952 NUMBER 7

The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

SHOP PRACTICE

Latest Ideas in Tool Engineering Applied to Jet-Engine Production — *By George H. DeGroat* — 152
Cleaning Work by Using Ultra High-Frequency Sound Waves — *By Charles R. Fay* — 158
Unique Dies Pierce Gas Traps for 3.5-Inch Rockets — *By Donald H. Smith* — 178
Forming Sheet Metal with Low-Cost Tools — *By J. A. Whittingham* — 186
Broaching 6-Foot Tank Turret Rings with Work Encircling the Machine — *By Colonel R. E. Hanes* — 192
Bending Tubes to Different Radii with a Triple Die — 195
Latest Production Equipment to be Seen at the Show — 198
Pickling Recommendations for Nickel and High-Nickel Alloys Prior to Welding (Data Sheet) — 261

MACHINE AND TOOL DESIGN

Tools for the Impact Extrusion of Magnesium — *By George H. DeGroat* — 162
Special Tooling Speeds Operations on Automatic Turret Lathes — *By A. E. Ryan* — 168
Precision Gages for Jet-Engine Turbine Buckets — *By Edward J. Pirner* — 172
Converting Oscillating Circular Motion into Variable Reciprocating Movement — *By W. M. Halliday* — 219
Unique Pumping Mechanism Applied to a Homogenizer — 220
High-Speed Steel Milling Cutter Design for Milling Stainless Steel (Data Sheet) — 261

MANAGEMENT PROBLEMS

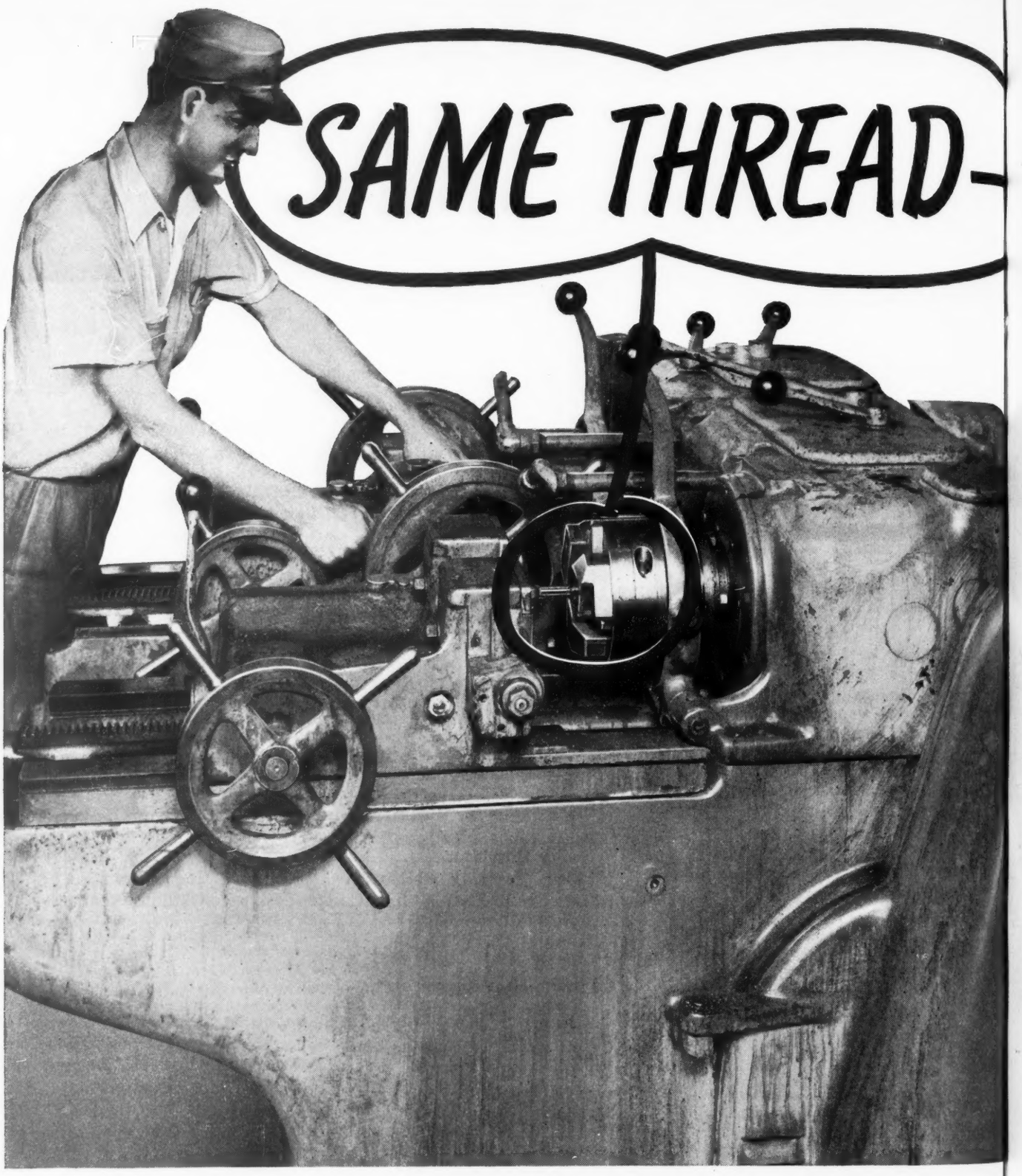
Keeping up with Washington — *By Loring F. Overman* — 141
Security Depends on Productivity — *By Charles O. Herb* — 143
Precision Control—A "Must" for Security — *By J. J. Demuth* — 146
The Sales Engineer and His Problems—Exact Estimates or "Guesstimates" — *By Bernard Lester* — 222

DEPARTMENTS

Keeping up with Washington — 141
Questions and Answers — 218
Ingenious Mechanisms — 219
The Sales Engineer — 222
The Latest in Shop Equipment — 224
Between Grinds — 255
News of the Industry — 256
Data Sheet — 261
New Catalogues — 271

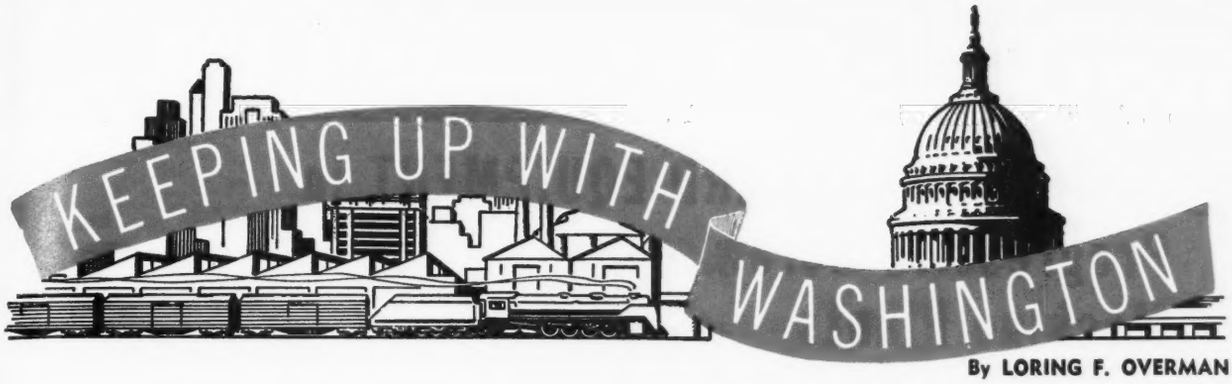
Product Directory
285

Advertisers Index
471-472



LANDIS Machine CO.

THE WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF THREAD



By LORING F. OVERMAN

Machine Tools Go to the Senate

THE machine tool situation, which has been the subject of industry frustration and considerable name-calling for some months, reached the floor of the Senate on January 23 in a report by the Joint Committee on Defense Production. As submitted by Senator Maybank, the report recommended that the machine tool industry be given additional financial assurance through modification of interest rates on pool-order advance payments, and extension of profits on uncompleted tools in the event of contract termination.

Although the report summarizes rather well some of the problems encountered by the machine tool industry in tying in on the defense program, Senator Maybank conceded that his committee has no power to enforce its recommendations. These, he explained, must be handled through appropriate standing committees of the House and Senate.

Perhaps it was this lack of assurance of action that caused Tell Berna, general manager of the National Machine Tool Builders' Association, to issue a blistering statement in Cleveland, on January 24, placing upon "Washington stupidity" the blame for his industry being considered the "bottleneck" of the defense program. He indicated that it would be two years before machine tools will be available in the needed quantities.

ILLUSTRATIVE of the wide gap between industry and government thinking on the subject of machine tools is the following comment from the Joint Committee report: "The machine tool shortage is by no means over, but the major bottlenecks are now virtually broken. Industry has the necessary aids to expand production month after month until machine tools are no longer a critical bottleneck."

The committee suggested these additional steps:

1. Modification of the 4 per cent interest rate now charged on the 30 per cent advance payments extended under pool-order contracts, either through elimination of the charge or permission to include this interest as an element of cost.

2. Extension of the same profit margin on uncompleted tools in the event of contract termination as applies on completed tools under the pool-order contracts.

3. Establishing of a renegotiation policy for the machine tool industry. The machine tool industry is covered now by general regulations difficult to apply in this field.

4. Finding ways to prevent defense plants from pirating skilled workers from machine tool companies because of higher wages authorized for certain defense plants.

The report also discussed foreign requirements for machine tools, observing that the Mutual Security Administration is making a determined effort to carry out a constructive program. It was mentioned that every North Atlantic Treaty Organization program "has been screened for essentiality and the required tools correlated with production target dates." This report (Senate Report No. 1107) was ordered printed, and will be available at the Senate Document Room, Washington 25, D. C.

THROUGH Amendment 30 to Ceiling Price Regulation 30 (the machinery regulation), OPS has tried to clarify the question of which installation services sold in connection with machinery or equipment should be priced under CPR 30 and which under CPR 93—the construction contractors' order. The agency pointed out that machinery and other heavy industrial equipment is often installed at the buyer's plant by the manufacturer in an operation identical with that of a construction contractor. The job may require masonry, plumbing, wiring, and other related construction materials and skills, with widely varying costs.

The agency, therefore, ruled that such services should be priced under CPR 93, and that engineering or supervisory services sold in connection with the sale of a commodity—or such services included in the base period price of such a commodity—shall continue to be priced under CPR 30.

SINCE January 22, NPA has required that all applications for priorities, materials, or other types of assistance be made in triplicate. NPA explained that it had adopted the new procedure to provide essential information to all NPA divisions or bureaus concerned in acting on the request. It is expected to save two to ten days' time in processing requests. NPA recently approved a new form (NPA-132) "Application for Adjustment or Exception" that simplifies the filing of requests in triplicate and outlines the information required of the applicant by NPA.

IN Direction 1 to Order M-6A—the basic steel warehouse order—operators of warehouses were ordered to give preference to authorized controlled materials orders placed by the military, the Atomic Energy Commission, and machine tool builders. The Z-2 symbol is to be used in placing orders for controlled materials required by machine tool builders.

Issuance of the warehouse order, NPA explains, is one of several steps being taken to expedite the production of machine tools needed in the defense program. Another is the recent moving of the Munitions Board machine tool unit, headed by Robert R. Sweene, to offices at NPA headquarters.

A fourteen-acre cave near Atchison, Kan., has been leased by the Department of the Army as a storehouse for specialized defense production machines not yet needed in the defense program. Ideal storage conditions in the cave include constant temperature and humidity, ample illumination and ventilation, and connections with three railroads.

HARDINGE
ELMIRA, N.Y.

TOOLING For PRODUCTION

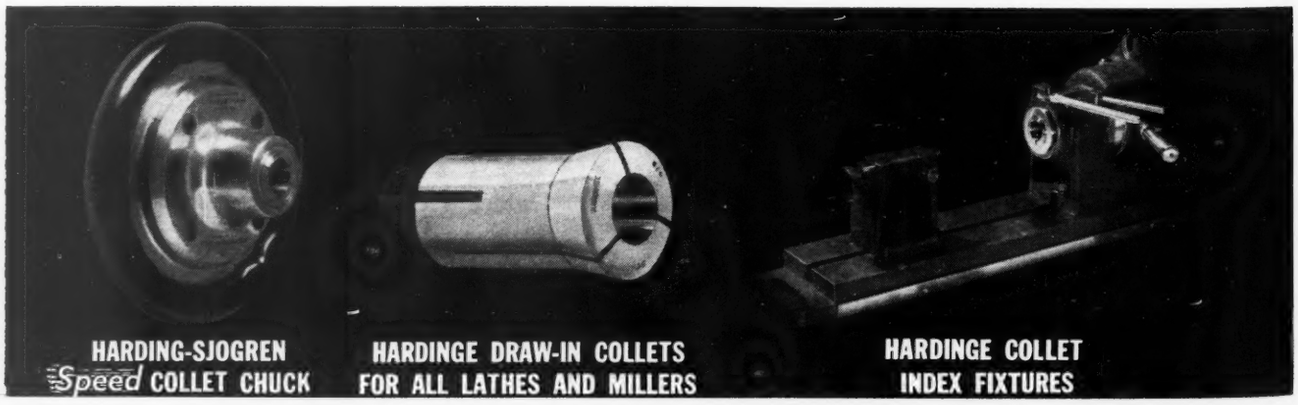
STANDARD EQUIPMENT in
Progressive Screw
Machine Plants

Style "S"
Master Collets
and Pads

Style "B"
Master Feed Fingers
and Pads

A.S.T.E. SPACE 1516

See the **only** Master Collet with no work pressure on the screw. Pads are interchangeable among different makes of automatics. Also included will be the complete line of Hardinge Collets and Feed Fingers for all makes of Automatics, Chucking Machines and Turret Lathes.



HARDING-SJOGREN *Speed* COLLET CHUCK

HARDINGE DRAW-IN COLLETS FOR ALL LATHES AND MILLERS

HARDINGE COLLET INDEX FIXTURES

Security Depends on Productivity

TWO kinds of security are troubling the free nations of the world—economic and military. Both of these are dependent upon the productivity of industry, although the average citizen is not generally aware of the fact. It is only through mass production that high standards of living can be attained, and, similarly, it is only through a vast output of military goods that nations can arm themselves for successful defense against aggressors.

Never before in the history of the world has a nation been called upon to produce war materiel on a huge scale and at the same time to maintain a high civilian economy. This is the problem that faces American industry today. The objectives can be achieved only by the development of the most efficient production methods.

The Industrial Exposition to be held this month in Chicago by the American Society of Tool Engineers, and the many technical sessions scheduled to run concurrently, will provide a stimulus to tool engineers of metal-working and machine-building plants who are now tooling for security. Every square inch of floor space in the amphitheatre will be occupied by exhibits that should provide innumerable ideas for improving manufacturing methods through the application of advanced tooling and for insuring greater work accuracy and quality by the use of precision control equipment.

Forty papers will be presented at the technical sessions, and there will also be daily panel discussions. On the technical program, the first day has been designated "Precision Control Day," and all papers will discuss phases of that subject. Similarly, the following days will be devoted, in turn, to metal-cutting, materials forming, grinding and finishing, and machine accessories, drives, and controls.

Machine tools have been considered the No. 1 problem on the production front of national defense. But machine tools in production lines must be efficiently tooled up and means provided for precise control of their output if they are to serve their purpose to the highest extent. The Tool Show will point the way to economic and military security through maximum productivity.

Charles O. Herb

EDITOR

Bring Your Steel Problems to These Men... at ASTE Booth 147

Here are some of the Ryerson steel specialists you'll meet at the Tool Engineers' Show in Chicago. Each is an expert in his field. Together they make up a consulting service that's ready to work for you.

What is your steel problem? If it concerns the application, selection or processing of carbon, alloy or stainless steel—tubular products or tool steel, these men can help you find the right answer. They can suggest practical alternates for restricted steels. Answer your questions on how to heat treat unfamiliar alloys—weld an unfamiliar stainless. Help you on these problems and many more.

Although a few steels are still in short supply, we can meet most of your requirements promptly from stock. For the complete steel picture, as we see it here at Ryerson, we invite you to write or visit our nearest plant and talk with our men at ASTE Booth 147—March 17 to 21 inclusive.

RYERSON STEEL

RYERSON CERTIFIED STEELS

JOSEPH T. RYERSON & SON, INC. PLANTS: NEW YORK • BOSTON • PHILADELPHIA • DETROIT • CINCINNATI • CLEVELAND
PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SEATTLE • SPOKANE

Chicago River, Wacker Drive, and Skyline—Photo by Ewing-Galloway

Tooling for Security

Productivity is the key to economic and military security for the free peoples of the world. America has shown the way in the past, but with the present threat from aggressor nations, it is imperative that we surpass even our great production records. That is why the Industrial Exposition of the American Society of Tool Engineers, to be held in Chicago, March 17 to 21, is especially timely. The latest types of tools and precision control equipment that will be displayed there will enable manufacturers to obtain maximum output from their machine tools. Ideas for greater productivity can also be obtained from the articles in this special Tool Engineering number, which deal with outstanding accomplishments of tool engineers.

Precision Control—A

By
J. J. DEMUTH, President
American Society of Tool Engineers

THE free world today is at a critical point in its growth and progress. It has seen its numerical superiority in population shrink day by day as the creeping paralysis of communism undermines government after government. It has witnessed its engineering superiority vanish to a point where, by hook or by crook, the Red nations can produce in quantity military equipment equal in performance to the best the free world can now put on a field of battle. This year the communist nations will even graduate more engineers than the free world.

Our only superiority—and I am not ignoring atomic weapons—is our inherent capacity to produce and outproduce any nation or combination of nations in the world. Right now, however, it is only a *capacity* to produce. We are not yet using that capacity.

At the present time, the free world, being made up of individuals who believe in the rights of individuals, is in the midst of a huge expansion program whereby the peacetime products that have fostered its great economy may be produced simultaneously with the huge quantities of military equipment most of us feel are needed to insure the peace.

We call this huge expansion program "Tooling for Security." It is not a program that is going to be over in a few years. It is a program that is based on conditions that the free world will have to face for years to come. And it must be geared to assure victory in spite of our deficiencies in numbers and the current weaknesses of our allies. There are problems in this program; many problems that the tool engineer alone can solve. If he does not solve them, it is entirely possible that we, of this generation, may see the free world, and all of the fruits that its system has produced for the individual, vanish from the face of the earth.

The solution, of course, lies in maximum productivity—maximum number of usable pieces produced per man-hour and per machine-hour. In that word "usable" lies one of our most important problems, the key to which is control of precision. Control of precision, it should be understood, is not a temporary expedient. We must have it not only to meet military needs, but also to satisfy civilian economic requirements—not only today, but for at least a generation to come.

By "precision control" is meant all of the methods and the kinds of equipment used to insure that machine operations will produce parts within specified limits of precision without relying on operator skill. It thus includes quality control, automatic and semi-automatic gaging on machines, tool control to insure continuous cutting accuracy, inspection devices for incoming materials and parts in process, and means of checking the working condition of machines.

Precision Control Increases Real Productivity

If a machine can produce one hundred pieces per hour, but only ninety of the pieces pass inspection, our goal of maximum productivity is not being achieved. In addition, if we have to inspect every part manually, we are sacrificing more valuable man-hours.

The production of pieces that do not meet design specifications has many detrimental effects. Since we have a smaller work force than our adversaries, we cannot produce equipment in

"Must" for Security

quantities sufficient to assure peace even if we should turn out the same number of pieces per man hour that they can. Any factor that tends to reduce real productivity defeats our needs.

Again, if we produce parts that are rejected at this time when materials are in short supply, an extra burden is placed on our materials program. In the guns and butter economy that we are striving to achieve, we have not yet solved the materials supply problem, and we must strive to turn every available pound of raw material into usable parts.

Here is another factor. When an assembly line is installed, it is geared to meet a production schedule, and the machine tools that supply the parts for the assembly line are provided in just the right quantities to meet this schedule. It only takes the lack of one part to stop an assembly line. If rejected parts are not kept to a minimum on every production operation, assembly lines may be slowed, or even stopped, and productivity drops.

Rejected parts have still another adverse effect on productivity because they add salvage operations, both in inspection and production departments. If you add operations, you add men and if you add men for unnecessary operations, you reduce the total available work force on productive operations.

Why is Precision Control Important Now?

But why is this control of precision so important now? Why are tool engineers devoting so much effort to it now? And why must they direct even more efforts in its behalf?

One reason why precision control is so important is that it is a method of increasing real productivity without adding workers to the labor force or providing additional machine tools. Right now one of the most critical factors in our military production program is the shortage of machine tools. We simply cannot increase productivity quickly just by ordering more or better machine tools. It takes a long time to get additional new machine tools at this stage of our expansion program, and no one can predict when the condition will improve. Thus the tool engineer must apply methods to increase productivity that will not further overburden the machine tool production program.

We are at present in a critical period when our work force is facing some unemployment until the military programs are fully under way. When our dual production program is in full swing, the story will be different. We know all too well that we will not be able to add to the labor force if we want to increase productivity. Similarly, more machine tools won't help. The addition of any machine tool means the addition of one or more operators. It is imperative, therefore, that we make each machine tool, with its operator, produce the maximum number of pieces, all of which will meet specifications. If we can do this, we've made a big step in providing for both military and economic security.

At the present high state of machine tool design development, you can add ten pieces per hour a lot easier by reducing the number of rejected parts than you can by demanding machine tools of higher production rates to offset the effect of rejections on productivity.

Another major reason why precision control is so essential is our lack of a skilled labor reserve. In the old days when every machine operator was a skilled machinist, he set up his machine, ran it, and checked the parts as they were produced. He even ground his own cutting tools.

Progress in production methods and machine tool development, on the one hand, and Union opposition to apprentice training programs, on the other, changed all this. The skilled machinist went into the tool-room or the machine repair department. Control of the machine tool became less and less an operator function. Grinding of tools went into a special department. And inspection became a routine use by other individuals of snap gages, hardness testers, and special indicator fixtures.

This systematic method of breaking down job functions and providing push-button high-production machine tools has resulted in greater productivity than any system of enterprise has ever before produced. It won two wars for the free world, but it trained no skilled workers.

No longer does the operator have the time, responsibility, interest, or the skill to inspect pieces coming off his machine. And in the face of this situation we are asking machine tools to produce parts to closer and closer tolerances at higher and higher rates. Unfortunately, it is easy to make a lot of parts that will not pass inspection—and make them fast—on high-production, close-tolerance work.

To reduce this high production of rejected parts we have devoted in the past a portion of

our work force to the control of precision through inspection. But inspection just detects defective parts. It doesn't correct the situation, despite the more and more complex gaging equipment we have produced for each type of manufacturing process.

Also, in our current military production program, industry is being asked to machine tougher and harder materials and yet maintain close tolerances. We cannot afford to have an inspector at every machine because inspection is, in reality, a non-productive operation. And even more important, we do not have skilled operators capable of using complex inspection devices.

Another reason why precision control is such an important consideration in our current economy is the decentralization of manufacturing operations that is occurring in industry, due both to intentional dispersion of plants and the trend to sub-contracting. When production parts are produced and assembled into the finished product under the same roof, an efficient system dictates that a minimum number of pieces be ahead of the line. Mild laxity in precision control, though always critical, is not as detrimental when rejections show up in assembly operations in an organization of this type.

It is a well known fact that the military forces favor dispersion of industry in America. But, when parts are shipped to assembly plants by suppliers or other divisions from distant points, the situation is extremely critical as soon as rejections begin to show up in assembly operations. Under these conditions, large quantities of parts are in shipment, salvage operations are remote from the assembly plant, and parts of the required specifications to replace the defective parts cannot be obtained quickly.

Control of precision at the machine offers another indirect advantage that results in increased productivity. This is its beneficial effect of decreasing machine "down" time by reducing tool failures. Dull tools reveal themselves by producing rough surfaces and dimensional inaccuracies. If precision control methods are carefully applied to machining operations, these characteristics are checked and the machine is shut down before the tools dull to the point where failure may occur. It has been well established that tools which are sharpened before they become excessively dull produce more total pieces and smoother surfaces than ones that are allowed to cut until complete cutting-edge breakdown occurs.

A recent A.S.T.E. survey revealed that machine tool "down" time is a very important factor right now. And precision control of manufacturing processes can be a factor that will help to improve this critical condition.

Requirements of Precision Control

What are the requirements that precision control equipment must meet to assure an increase in productivity and reduce the size of the inspection work force?

1. Precision control equipment should check the accuracy of an operation *at the operation,* not after several subsequent steps have taken place. Inspection of bar stock or forgings for flaws, hardness checks, and grain structure analysis should be made *before* machining operations start—not at the end of the line after much productive time has been invested in the part.

2. Precision control methods should stop a machine from producing rejections when the first rejections are produced—not after many have been turned out. This is an important factor, and one that cannot be solved by merely put-

ting inspectors at every machine. It could be solved by automatic gaging equipment that would render the machine inoperative the minute a part that does not meet specifications is produced.

3. Equipment for precision control must be extremely accurate. Gages that let rejections pass on to the assembly line have an even greater adverse effect than ones that check operation accuracy many operations ahead, since rejections are produced in quantity until assembly of parts or actual product operation reveals their inaccuracies. The higher accuracy demanded today, particularly of much of our military equipment, means that the precision control equipment must also be of greater accuracy.

4. Precision control equipment should be simple to operate and interpret. Even though high accuracy is a necessity, simplicity of operation is an important consideration, since less labor skill is required. Such equipment should be of the direct reading type, if feasible.

5. Precision control equipment should be as automatic as possible. This is one of the most important features. It will release inspection personnel for productive operations if utilized to the fullest extent. Many multiple-operation machine tools are now being provided with automatic gaging equipment for each operation. Grinding equipment has for many years been available with gaging devices that control the precision of the production. More equipment of this type is a "must" if we are to make the most of precision control methods.

6. Precision control equipment and methods should predict when rejections are going to be produced, rather than show that they have been produced. This can be achieved by application of statistical methods. Quality control, as such methods are usually called, has proved its value in assuring accurate parts, reducing inspection operations, and giving a quick picture of the status of control of accuracy on any particular operation or sequence of operations.

Precision Control Not a Cure-All

Will promotion of precision control methods alone assure that we can meet the needs of tooling for security? The answer, of course, is "No." We have a great materials expansion program that must be achieved if our goal is to be met. We also have the problem of avoiding mass unemployment as we gradually build up our military program and reduce peacetime production programs, while, at the same time, building up the materials supply.

The large plant expansion program that has been undertaken to provide facilities for military equipment manufacture has to be speeded to completion before we can sit back and relax with the knowledge that we have attained a portion of our goal—that we have provided both a peacetime and military economy simultaneously.

Industry has stated that it needs more accurate machine tools, with higher productive capacity, more automatic controls to meet the unskilled labor problem, and cutting tools that will have longer life while machining the new tough metals of modern industry. All of these contribute to increased productivity.

The point to consider about precision control methods is that they can be applied right now to increase productivity. Day by day, as each military production line starts up, we must make certain that a minimum number of rejections are produced. We can also apply these methods right now to peacetime production, and assure that a minimum number of machine tools and

(Concluded on page 212)

Some of the Engineers Who will Present Papers at the Show

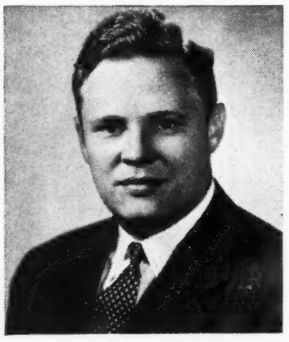
R. E. Gay, President, Bristol Brass Corporation, who will present a paper entitled "The Part of Standards in Better Consumer Relations" in the technical session on Monday, March 17

I. L. Wallace, Manager of Engineering, Carboloy Department of General Electric Co., co-author of "New Developments in Cemented Carbides," to be presented Tuesday, March 18

Dr. J. V. Strela, Staff Statistician, Thompson Products, Inc. His paper, entitled "Criteria for Selecting Sampling Methods," will be presented Monday afternoon, March 17

J. S. Gillespie, Manager of Product Sales, Carboloy Department of General Electric Co., co-author, with Mr. Wallace, of "New Developments in Cemented Carbides"

John Loxham, Managing Director of Sigma Instrument Co., Ltd., will read a paper entitled "Control of Quality on Mass-Produced Engineering Parts" on Monday evening, March 17



Dr. S. G. Fletcher, Chief Metallurgist, Latrobe Electric Steel Co., who will present a paper entitled "The Selection and Treatment of Die Materials" on Wednesday, March 19

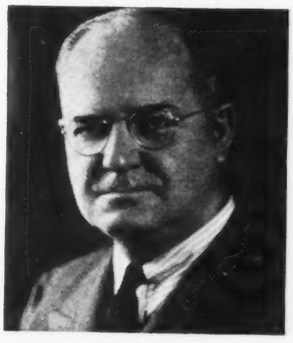
F. Judkins, Chief Engineer, Carbide Division, Firth-Sterling Steel & Carbide Corporation, will present a paper "Electromechanical Machining of Hard Materials" on Tuesday, March 18

J. D. Graham, Works Metallurgist, Farm Tractor Division, International Harvester Co., will discuss the subject "Machining and Heat-Treatment of Boron Steels" Wednesday evening, March 19

James Meehan, Sales Division, Brown & Sharpe Mfg. Co., who is co-author of a paper "Production Grinding of Cylindrical Parts Requiring Extreme Precision," to be presented Thursday, March 20

E. J. Pavesic, Research Director, Lindberg Steel Treating Co., will discuss heat-treatment at the session to be held on Friday, March 21, in a paper entitled "Practical Aspects of Tool and Die Heat-Treatment"

A. E. Mandeville, Application Engineer of Brown & Sharpe Mfg. Co., co-author, with Mr. Meehan, of the paper "Production Grinding of Cylindrical Parts Requiring Extreme Precision"



J. C. Hanna, Vice-President and Chief Engineer of Hanna Engineering Works, who will present a paper entitled "Principles for Selecting Pneumatic versus Hydraulic Drives" on Friday, March 21

B. H. Work, Assistant Sales Manager, Bonded Products & Grain Division, Carborundum Co., who will speak on "Precision Production Grinding" Thursday, March 20

H. L. Stewart, Assistant Sales Manager of the Logansport Machine Co., who will present a paper dealing with the subject of "Power Chucking" on Friday, March 21

L. E. Doyle, Associate Professor of Mechanical Engineering, University of Illinois, will present a paper "Analysis of Cost Estimating Principles and Practices" on Friday, March 21

H. G. Keller, Assistant Chief Engineer, Link-Belt Co., has prepared a paper on mechanical drives entitled "Mechanical Variable-Speed Drives," which will be presented on Friday, March 21

Latest Ideas in Tool to Jet-Engine

Some of the New Equipment Installed at Pratt & Whitney Aircraft to Speed the Production of Thin-Walled Stainless-Steel Rings, Turbine Cases with Varieties of Hole Patterns, Nozzle Vane Assemblies, and Other Jet-Engine Parts Requiring Special Set-Ups

By
GEORGE H. DeGROAT

THE problems encountered in jet-engine production are considerably different from those found in the manufacture of piston engines. New and tougher materials, large-diameter parts of thin-walled section, and other jet-engine components with design features not ordinarily found in piston engines have created the need for new tooling methods and new machines. In addition, increased production rates arising from the defense effort have made obsolete many of the production methods that were formerly acceptable for the peacetime rate of output.

To meet these needs, the Pratt & Whitney Aircraft Division of United Aircraft Corporation, East Hartford, Conn., has carried out a production-engineering program which has resulted in the design and procurement of several new and wholly different types of machine tools. A flexible drilling machine with three heads and adjustable spindles is one of these. This universal circular drilling machine, which was developed in collaboration with the New Britain Machine Tool Co., is capable of drilling a large variety of patterns having as many as 196 holes in work up to 48 inches in diameter. No expensive drill jigs or fixtures are required, and the machine can be used for drilling, reaming, and counterboring a part at one set-up, with one tool in each spindle. In some cases, two different parts can be handled simultaneously.

Drill bushings are supported in movable brackets under the drill spindles. The spindle supports can be moved about the circular base through approximately 300 degrees of the perimeter, sliding on two steel guide-ways. Thus the spindles can easily be located at any desired point.

The table is 46 inches in diameter and is mounted on a large spindle with two independent radial ball bearings, the outer bearings supporting the table nearly to the outside edge. This facilitates rotation of the table, which is accomplished manually by means of a large handwheel. A shot-bolt, operated by a foot-controlled air cylinder, locks the table in the working position for each hole, or indexing location.

An application of one of these machines is illustrated in Fig. 1. The work is a stainless-steel turbine case approximately 30 inches in diameter and has two projecting flanges, each about 0.250 inch thick. The operation involves the drilling of thirty-six holes in each flange, the hole size being 0.265 inch in diameter, plus or minus 0.005 inch. The holes, equally spaced within 0.005 inch, are 2.615 inches apart. All three spindles are used simultaneously, each one drilling twelve holes in one flange, the machine table being indexed that number of times.

To index the table, the operator retracts the shot-bolt by stepping on the foot-treadle, which trips an air cylinder; then the handwheel is turned to rotate the table, stopping at the approximate center of the next index-pin, after which the shot-bolt is released. The bolt moves in slowly to engage the locating pin without jarring the table or straining the pin.

In Fig. 2 it will be noted that every sixth pin of a total of seventy-two index-pins on the table

Engineering Applied Production

is uncovered so that visual indexing is simplified, the unused pins being covered. Changing over from one hole pattern to another can be made in a few minutes, provided the number of holes required is a multiple of the number of index-pins around the periphery of the table and the spacing is consistent. The index-pins are initially spaced by means of ground discs of equal diameter to give the correct chordal distance for the required number of holes. When holes must be spaced at odd locations, the index-pin position is determined by V-links.

When the first flange on the turbine case has been drilled, the part is turned over and the operation is repeated on the second flange. To insure perfect alignment of the second set of holes with the first, a tapered pin is inserted through one of the first set of holes, now in the lower flange. This engages a locating hole in the fixture on the machine table, which may be seen in Fig. 2.

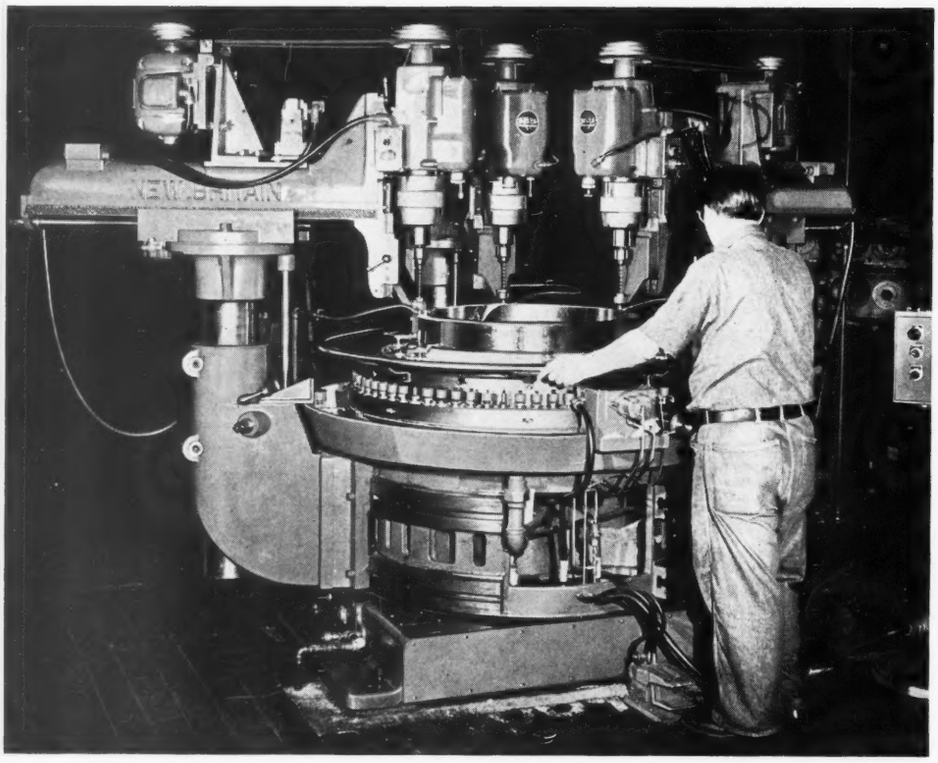


Fig. 1. Large-diameter jet-engine parts are drilled, reamed, and counterbored or tapped in one set-up in a universal circular drilling machine with three heads

Another application of this machine is illustrated in Fig. 3, where two different parts are shown being machined at one time. These parts are the outer and inner turbine nozzle vane supports, made from A M S 5651 steel forgings. After rough- and semi-finish-machining in a Bullard vertical turret lathe, the two parts are clamped in the locating fixture shown on the New Britain machine. A set of forty-eight locating holes, 3/16 inch in diameter and 1/8 inch deep, is drilled in one face of each part, using the first and third spindles with the second spindle idle. These holes insure the proper positioning of the support ring when it is stamped with banana-

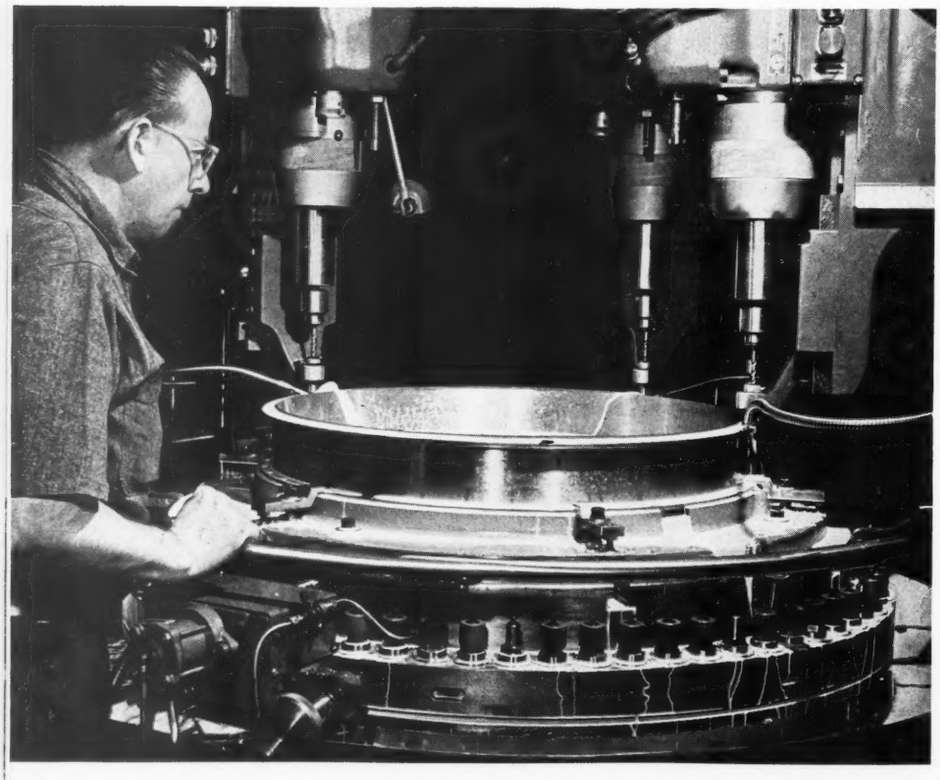


Fig. 2. A stainless-steel turbine case, 30 inches in diameter, has thirty-six holes drilled in each of two flanges in the circular drilling machine seen in Fig. 1

Fig. 3. Two different parts, the outer and inner turbine nozzle vane supports, are drilled simultaneously in one set-up of the circular drilling machine

shaped holes to receive the airfoil-shaped nozzle vanes. The spacing is uneven and the location of the index-pins is determined by means of thirty-six discs of equal diameter and six each of two sizes of V-links. Hole locations are held within 0.005 inch. Burrs are removed after drilling by countersinking the holes with the same spindle and index-pin set-up.

One of the outstanding advantages of these machines is the ease with which the operator can see that the drills are always kept sharp, especially since stainless steel and other gas-turbine materials work harden rapidly the instant a tool fails to cut freely. When hole diameters are to be held to close tolerances, one spindle can be used for drilling and the second for reaming. In many such cases, the third spindle is employed for counterboring or tapping. Under these circumstances, of course, the first drilled hole must be under the spindle in which the reamer is held before that spindle is started, while the tapping or counterboring spindle is idle until the first reamed hole is under it. In this way, the first reaming operation may not occur until the table travels, say, one-quarter of a complete revolution, and the first tapping operation would not begin until one-half of a revolution has been completed. The drilling spindle, of course, would be stopped after all the holes have been drilled, while the other two spindles continue to be operated until the complete set of holes has been reamed and tapped.

Another special machine is shown in the head-

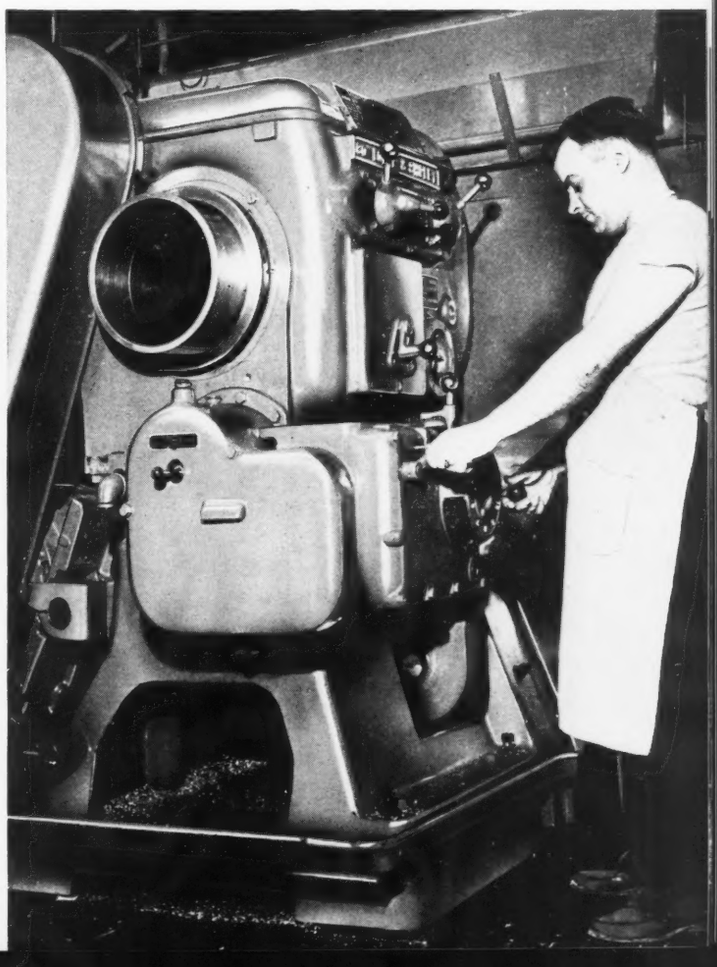


Fig. 4. Feeds and speeds on the right-angle chucking lathe are easily controlled. A spindle speed range of 4 to 225 R.P.M. and a feed range of 0.001 to 0.060 inch per revolution are available

Fig. 5. The design of the right-angle chucking lathe is such that it is easy for the operator to follow the progress of the work

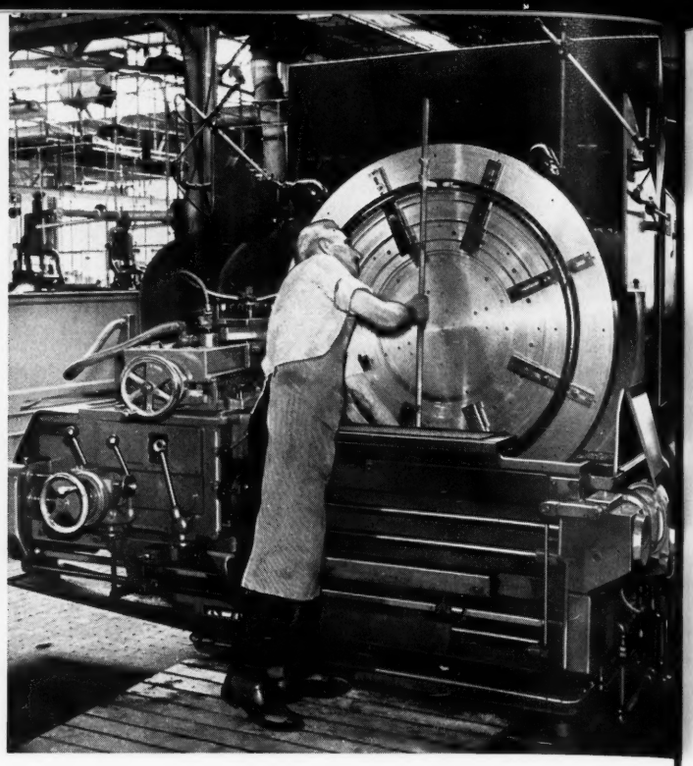


Fig. 6. Measuring large-diameter work machined in right-angle chucking lathes can be done more conveniently than in conventional machines

ing illustration. This Lodge & Shipley machine is a right-angle chucking lathe with a T-shaped bed and a 60-inch swing. The section on which the carriage is mounted is at right angles to the center axis, and the carriage supports a cross-slide which can move either parallel with or at any angle to this axis. Turning, facing, boring, or contour machining can be accomplished in this new machine by the use of the proper attachments.

This lathe was designed specifically for machining such thin-walled stainless-steel parts of large diameter as turbo-jet vane rings, blade shrouds, and tailpipes. These thin-walled parts are so flexible that they require great rigidity in a machining set-up, and since their diameters

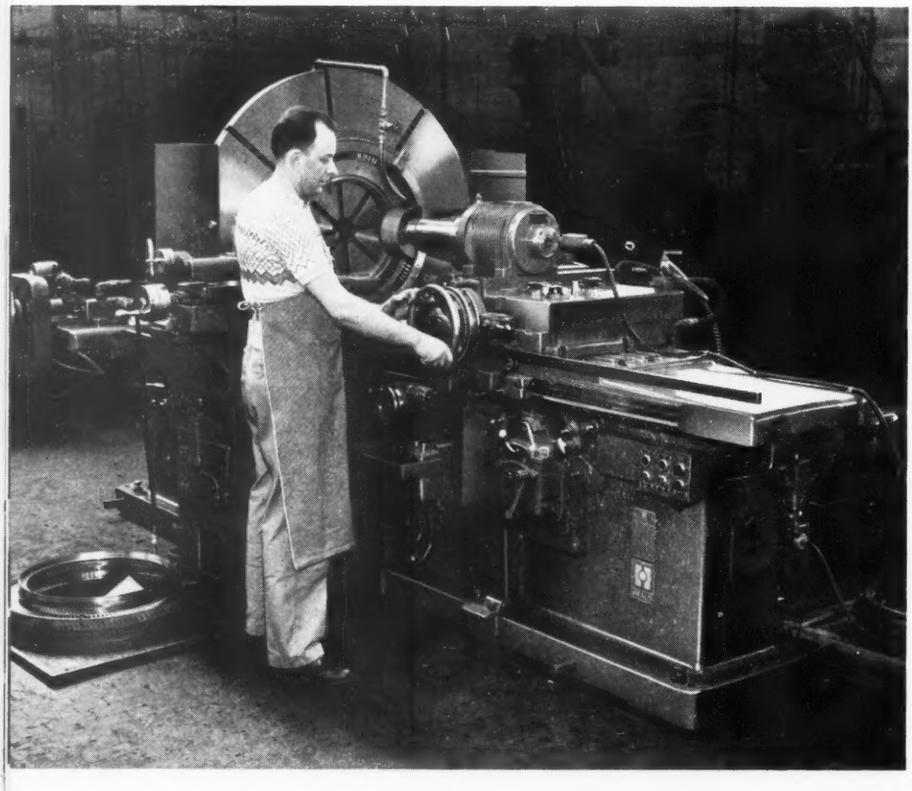


Fig. 7. An internal grinding machine with a lathe cross-slide mounted on its bed is employed for performing secondary lathe operations after grinding without disturbing the set-up

range up to 48 inches, a lathe capable of a large swing is needed. However, the cuts to be made on this work are relatively light and precise so that the horsepower of a conventional large, heavy-duty lathe is not needed. The resulting design combines the range of a large car-wheel lathe with the sensitivity of a tool-room lathe.

Tolerances as close as 0.001 inch are easily held, and all operations are controlled from the apron, Fig. 4. Twenty-five spindle speeds are available ranging from 4 to 225 R.P.M., and there are fifty-five feeds for the carriage and compound rest, ranging from 0.001 to 0.060 inch per revolution.

As may be seen in Figs. 5 and 6, the new lathe permits the operator to stand closer to the work, making it easier for him to follow the progress of the operation and to make precise measurements. A standard 25-inch diameter, heavy-duty headstock with a bore 11 1/2 inches in diameter is employed on this machine to permit chucking work with shafts or other extensions. Most parts, however, are clamped to an aluminum faceplate, which is 54 inches in diameter and 5 inches thick. As the faceplate has a low moment of inertia, it is easy to stop and start rotation of the work.

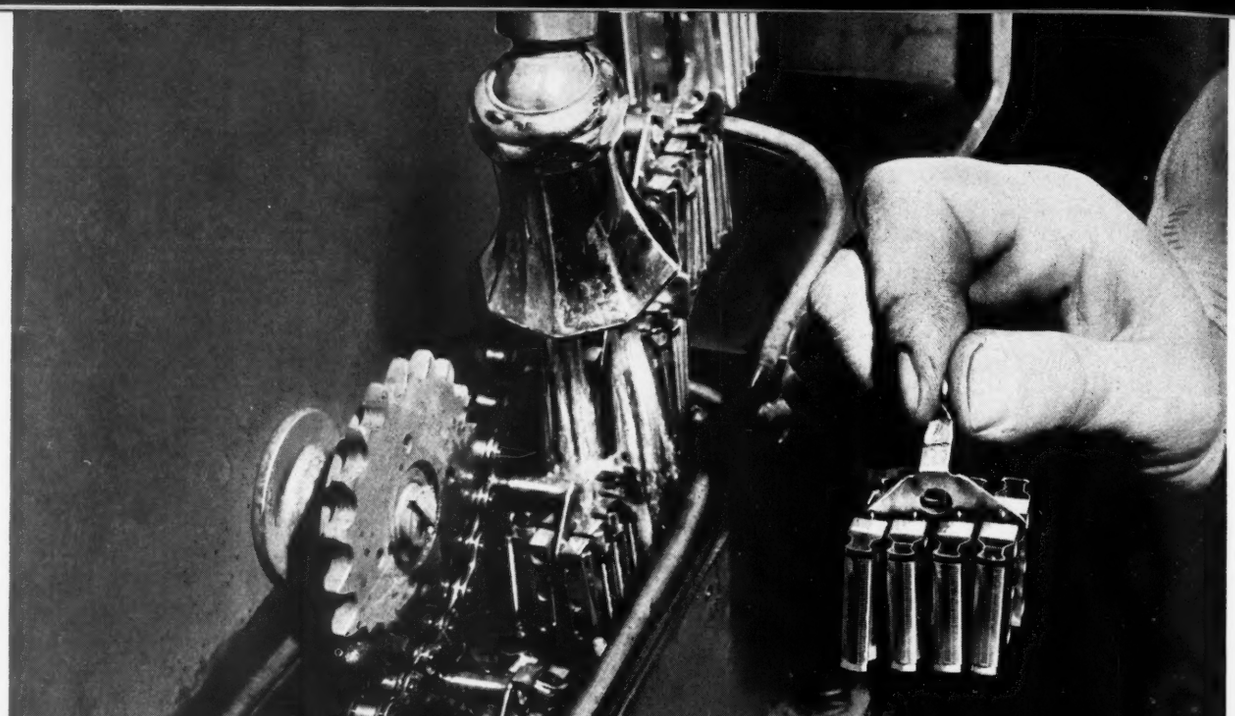
An unusual grinding machine is illustrated in Fig. 7, where a Heald internal grinder with a Monarch cross-slide mounted on its bed is shown. This machine was designed to facilitate light secondary operations on thin-walled rings or weldments, such as the compressor nozzle vane assembly shown. After grinding, such lathe operations as recessing, chamfering, and other secondary operations are quickly and easily performed without disturbing the set-up, thereby insuring a high degree of concentricity and considerably reducing set-up time.

Ordnance Sub-Contracts for Small Business Firms

SMALL business firms having idle metal-working equipment are urgently needed as defense sub-contractors, especially if the idle equipment includes planers, milling machines, cylindrical grinders, radial drills, and horizontal boring machines, according to a statement from Ordnance Ammunition Center, Joliet, Ill. Firms that submit a list of their available shop equipment to the Metal-Working Division of the National Production Authority, Washington 25, D. C., will be registered with machine tool builders, who are attempting to increase their production 400 per cent. The tool steel is available, according to the steel industry committee.

The Ordnance Ammunition Center stresses the point that it is not necessary to employ agents, advisors, or any agency on a commercial basis in order to obtain government business. It is only necessary to apply to proper government channels to obtain information or action on a commercial contract. The Ordnance Ammunition Center, for instance, has established a small business office offering engineering and other technical aid to manufacturers throughout the United States. The Center has already advised many small business concerns too small to handle prime contracts on procedures for obtaining requirements and bids on defense projects.

Statistically, small business firms received 75 per cent of all contracts and 30 per cent of the total dollar value of contracts awarded by the Army during the fiscal year ending June 30, 1951. These contracts are exclusive of the many sub-contracts let by prime contractors.



Grease, Oil, and Hard, Fine Particles of Embedded Dirt and Lapping Compound are Quickly and Easily Removed from the Precision Metal Shearing Heads of Schick Electric Shavers by Employing "Ultrasonic Activation" of the Solvent

By
CHARLES R. FAY
Chief Industrial Engineer
Schick, Inc.
Stamford, Conn.

A REVOLUTIONARY new method has recently been commercially applied to the cleaning of small precision metal parts. This method utilizes ultra high-frequency sound waves to agitate the cleaning solution. In a production "ultrasonic" cleaning machine designed by Schick engineers and built by the General Electric Co., high-frequency electrical current is converted into high-frequency mechanical vibrations of the solvent in the cleaning tank. When the work-pieces are immersed in the "ultrasonic activated" solution, the rapid agitation results in a more positive washing or scrubbing action. Improved cleaning is obtained at much higher production rates, and the cost of cleaning is reduced as much as 58 per cent.

The shearing heads for Schick electric shavers must be thoroughly cleaned to insure efficient operation. This task is made more difficult by the fact that the last manufacturing operation on the heads is lapping. The lapping compound enters tiny crevices, capillary spaces, and corners inside the shearing head, where the head block is welded to its shell, and is difficult to remove. Also, small dirt particles have a tendency to cake and harden on the surfaces and in the slots of the heads.

Previously, the shearing heads were cleaned in a jet type washing machine, and then brushed

Cleaning Work by Using Ultra High-Frequency Sound Waves

by hand. Even with this tedious, expensive method, rejections of inspected heads were high. With the ultrasonic process, more thorough cleaning is obtained at less than half the cost and with only one-third the floor-space requirements. The machine used in the new process is being adapted to the cleaning of other electric shaver parts.

The ultrasonic cleaning machine, shown in Fig. 1, consists essentially of an oscillator to generate radio-frequency electrical power; a matching coil assembly; a quartz crystal transducer, 2 inches in diameter, which converts the electrical energy into high-frequency mechanical energy in the form of ultrasonic vibrations; a cleaning tank filled with trichloroethylene; a chain conveyor mechanism; and an exhaust system. With the power oscillator supplying high-frequency voltage to the flat, round quartz crystal at its resonant frequency—750,000 cycles per second—the resulting mechanical vibrations of the crystal are transferred upward in the form of high-frequency inaudible sound to the trichloroethylene in the cleaning tank by means of a liquid conducting medium and a diaphragm attached to the bottom of the tank.

The liquid conducting medium—a slightly saline solution—serves as a sonic coupling between the crystal and the diaphragm. To minimize losses in transferring the energy, and to permit rapid vibration, the diaphragm is made only 0.003 inch thick. The cleaning machine is easily regulated by simple controls, and is electrically interlocked for safety of operation.

The theory of ultrasonic cleaning is that the tremendous speed of the generated vibrations accelerates the chemical and physical reactions of the trichloroethylene, thus increasing its emulsifying action on any oil or grease on the work. The force of the vibrating cleaning solution dislodges and disperses solid particles from tiny crevices that would ordinarily be inaccessible, and such particles become suspended in the solution. This violent agitation is distributed more or less uniformly throughout the cleaning solution.

Shearing heads for the electric shavers are

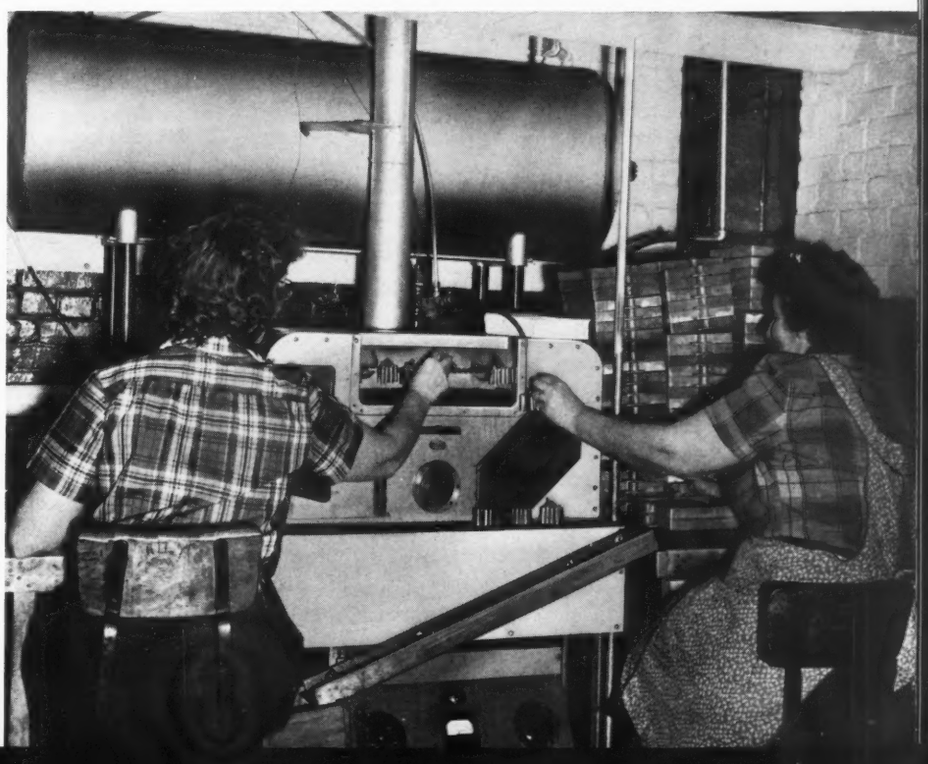
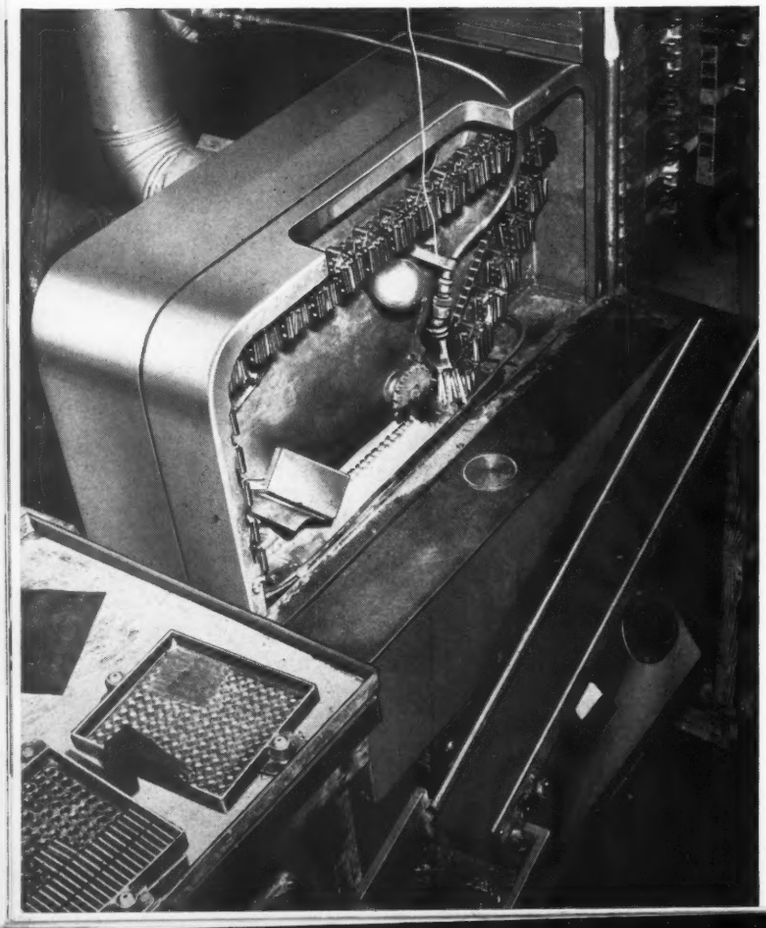


Fig. 1. The operator at left hangs racks of electric shaver shearing heads on chain conveyor of ultrasonic cleaning machine, while the operator at right unloads racks of clean parts

Fig. 2. Shearing heads for electric shavers are hung on racks, eight heads per rack, prior to loading on chain conveyor of cleaning machine



placed on racks and loaded on the chain conveyor by the operator seen at the left in Fig. 1. A close-up view of one of the racks is seen in the heading illustration. As shown in Fig. 2, each rack is inserted in a slot in a bench-mounted angle-iron, and a shearing head is hung on each of the eight prongs on the rack. The loaded racks are then placed on the chain conveyor of the machine.

A front view of the machine with the cover removed to show the chain conveyor is shown in Fig. 3. In operation, the racks are loaded and unloaded through an opening in the front cover. The chain, which is driven counter-clockwise, immerses the racks of shearing heads in the trichloroethylene bath, and carries them through the cleaning tank. The speed at which the conveyor is driven can be varied to suit the product being cleaned.

Ultrasonic cleaning is primarily applicable to metal parts having a volume of 10 cubic inches or less. The size capacity and rate of cleaning are dependent on the complexity of the parts to a great extent. The rate may be as high as fifty parts per minute or more with a single-crystal machine such as this one.

For the cleaning operation, the conveyor is set to travel at the rate of 18 inches per minute. At this rate, the heads remain immersed in the agitated portion of the solution for only 10 seconds. As the racks are lifted out of the cleaning solution, the parts are spray-rinsed with fresh trichloroethylene flowing from a shower head, as seen in the heading illustration.

Good results can be obtained in ultrasonic cleaning with several different solvents. The application of ultrasonic waves may accelerate the cleaning action of hydrocarbons or alkaline cleaning solvents by a factor ranging from 10 to 100. Best results have been obtained at Schick with trichloroethylene—a stabilized, chlorinated hydrocarbon.

Since trichloroethylene will boil at about 186 degrees F., the bath is maintained at approximately 135 degrees F. to minimize vaporizing and losses through the exhaust system. Also, a copper tube carrying cold water is provided around the cleaning tank—just above the level of the trichloroethylene, to serve as a condensing coil and limit the height to which vapors will rise above the liquid.

Contaminated solvent is reclaimed by piping it to a still. Here the trichloroethylene is purified and piped back to the tank. The ultrasonic clean-

Fig. 3. Front cover of ultrasonic cleaning machine has been removed to show chain conveyor. The chain moves counter-clockwise, immersing racked parts in trichloroethylene bath

Fig. 4. Visible evidence of the efficient action obtained in ultrasonic cleaning is given by the particles picked up from the bottom of the tank with a magnet

ing machine requires a flow of about 30 gallons of solvent per hour, and the tank is cleaned once a week. The collection of metal particles removed from the bottom of the tank with magnets, Fig. 4, gives visible evidence of the efficient scrubbing action of this cleaning method.

The operator seen at the right in Fig. 1, and also in Fig. 5, removes the racks from the chain conveyor, lifts the clean shearing heads from the racks, and stacks the parts in trays for inspection. Rejections have been practically eliminated by this process. Empty racks are dropped on a chute at the front of the machine, as seen at the right in Fig. 3, from which they fall into a bin that is conveniently located for the loading operator. Although the parts are only submerged for 10 seconds, it takes 5 1/4 minutes for each rack to complete the cycle.

In addition to providing faster and more effective removal of dirt, grease, and oil, ultrasonic cleaning has several other important advantages. One is that the machine requires a relatively small floor space—approximately 20 by 30 inches —and can therefore be placed directly in the manufacturing production line. Another advantage is that when the work-pieces leave the cleaning machine, they are warm and dry, due to evaporation of the solvent, and can be inspected, assembled, and shipped immediately. Also, a wider choice of final finishing compounds is permitted with this method. Some of the best buffing and lapping compounds are the most difficult to remove, and, for this reason, have often been avoided with previous methods of cleaning. The new process, however, will usually remove even the most obstinate compounds.

Fig. 5. The unloading operator removes the racks of clean shearing heads from the chain conveyor of the ultrasonic machine and places the heads in trays for subsequent inspection

Tools for the Impact

IMPACT extrusion is a method of producing small symmetrically shaped tubular parts. The part is made by placing a disc or slug of metal of the required volume into a heated die cavity and applying pressure with a punch. The pressure causes the metal to flow up around the punch, the clearance between the punch and die determining the wall thickness of the part.

The method employed in the production of magnesium impact extrusions at the Dow Chemical Co., Midland, Mich., is basically the same as for other metals, the main difference being in the temperature of the operation. With magnesium alloys, the temperature may vary from 350 to 700 degrees F., depending on the alloy used, speed of operation, and size of part.

Up to the present time, the majority of magnesium impact extrusions have been made in the sizes and shapes used in the dry-cell battery industry, Fig. 1, since this has been one of the most promising uses for magnesium. The parts required in this field consist mainly of round cans, varying in diameter from about 7/16 inch to 1 1/4 inches, and in length from 1 to 6 inches. Some square and rectangular impact extrusions have been made, as well as parts having flanges, ribs, and bosses.

The impact extrusion process is used to make such parts as collapsible tubes for toothpaste, shaving cream, and salves, as well as shields for electronic devices, shell cases, parts for electronic coils, caulking guns, blow-torches, hydraulic floats, oil filters, flashlight cases, lipstick tubes, cigarette-lighter cases, drinking cups, and a variety of structural parts, such as gusset clips for the aircraft industry. While all these parts have not been made from magnesium, they serve to illustrate the type of part that can be made by impact extrusion more economically than by other processes.

Some of the advantages of this process for making deep-formed parts include relatively cheap tooling, high production rates, and the possibility of making parts in one step that would require several steps by deep-drawing. (The last point does not apply to magnesium, which is normally drawn hot in one step.) Also, with the impact extrusion process, the bottom thickness of a part may vary within wide limits while the wall thickness is kept constant, and ribs, flanges, and bosses can be incorporated in the part.

Tools designed and made by the Independent Tool & Die Corporation, New York City, serve as excellent examples of those required for this specialized work. One set of these tools, used for the impact extrusion of the cylindrical magnesium tube illustrated in Fig. 3, may be seen in Fig. 2. The components of this assembly are made for use with a range of punch and die sizes. For example, three sizes of punches can be held in the collet and nut, details of which are shown in Fig. 4. The punch, Fig. 5, has a body diameter 0.004 inch smaller than the nib diameter. The face of the nib is flat, and the edges are beveled to an angle of 20 degrees to facilitate the flow of metal in the extruding operation.

Punch steels usually contain 5 per cent chromium, 1.5 per cent molybdenum, 1.25 per cent tungsten, 1 per cent silicon, and 0.35 per cent carbon. They are hardened to 58 to 60 Rockwell C, and ground to a very high surface finish. Generally, about 200,000 parts can be made before a punch must be reworked or replaced. Of course, a worn punch can always be reground for use in making a smaller size part of the same shape.

The slenderness ratio (punch length divided by punch diameter) is an important factor in determining the size of part that can be made. A slenderness ratio greater than 6 to 1 usually results in eccentricity in the extruded parts, because punches of these proportions tend to move laterally in operation.

Details of the die assembly are shown in Fig. 6. Although dies made of tool steel having the same analysis as that used for punches are sometimes used, carbide inserts are preferred because of their longer life and because they produce higher quality parts. The surface quality of parts made in carbide dies is better than that produced in steel dies, as carbide surfaces resist the welding of magnesium to the side walls. Tool-steel dies will usually produce about 200,000 parts before replacement is necessary, while carbide die life is estimated at 10,000,000 parts.

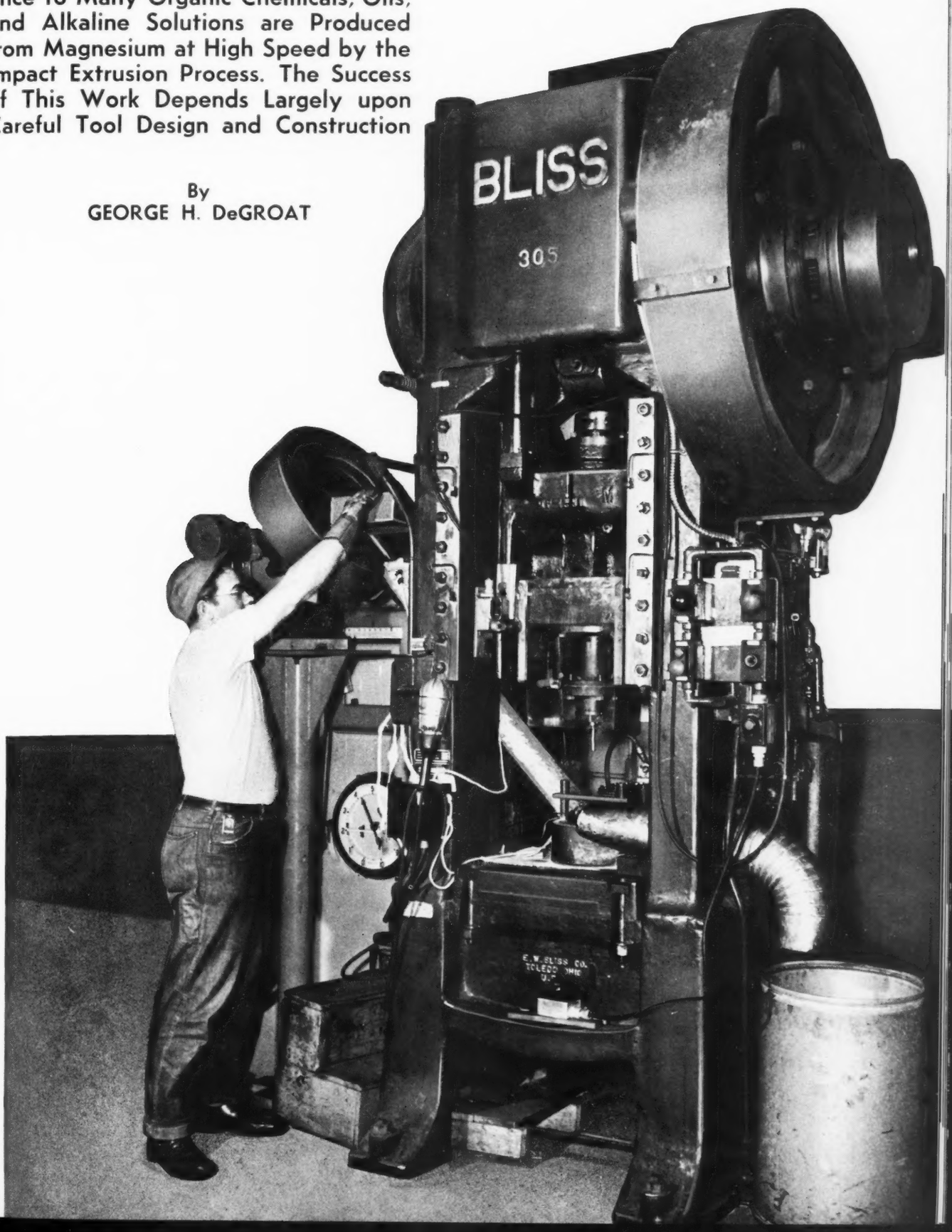
A taper of approximately 0.002 inch per inch of cavity depth is provided in the die to facilitate removal of the extruded part. The part remains on the punch at the end of the operation, and as it is lifted from the cavity by the punch, it is stripped mechanically by means of the stripper plate shown in Fig. 2.

Hardened and ground stripper jaws are inserted in the plate for this work. Four equally spaced radial saw slots, 1/32 inch wide, are machined in the jaw members to produce a dilating

Extrusion of Magnesium

Rigid, Light-Weight Parts with Excellent Electrical Conductivity and Resistance to Many Organic Chemicals, Oils, and Alkaline Solutions are Produced from Magnesium at High Speed by the Impact Extrusion Process. The Success of This Work Depends Largely upon Careful Tool Design and Construction

By
GEORGE H. DeGROAT



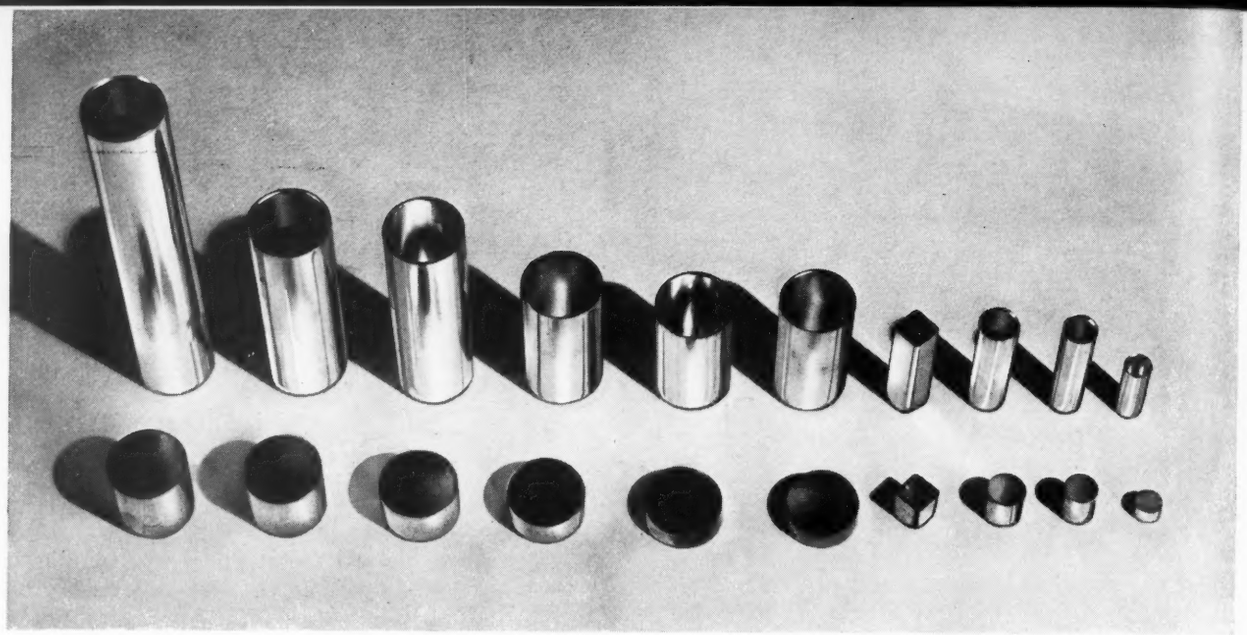
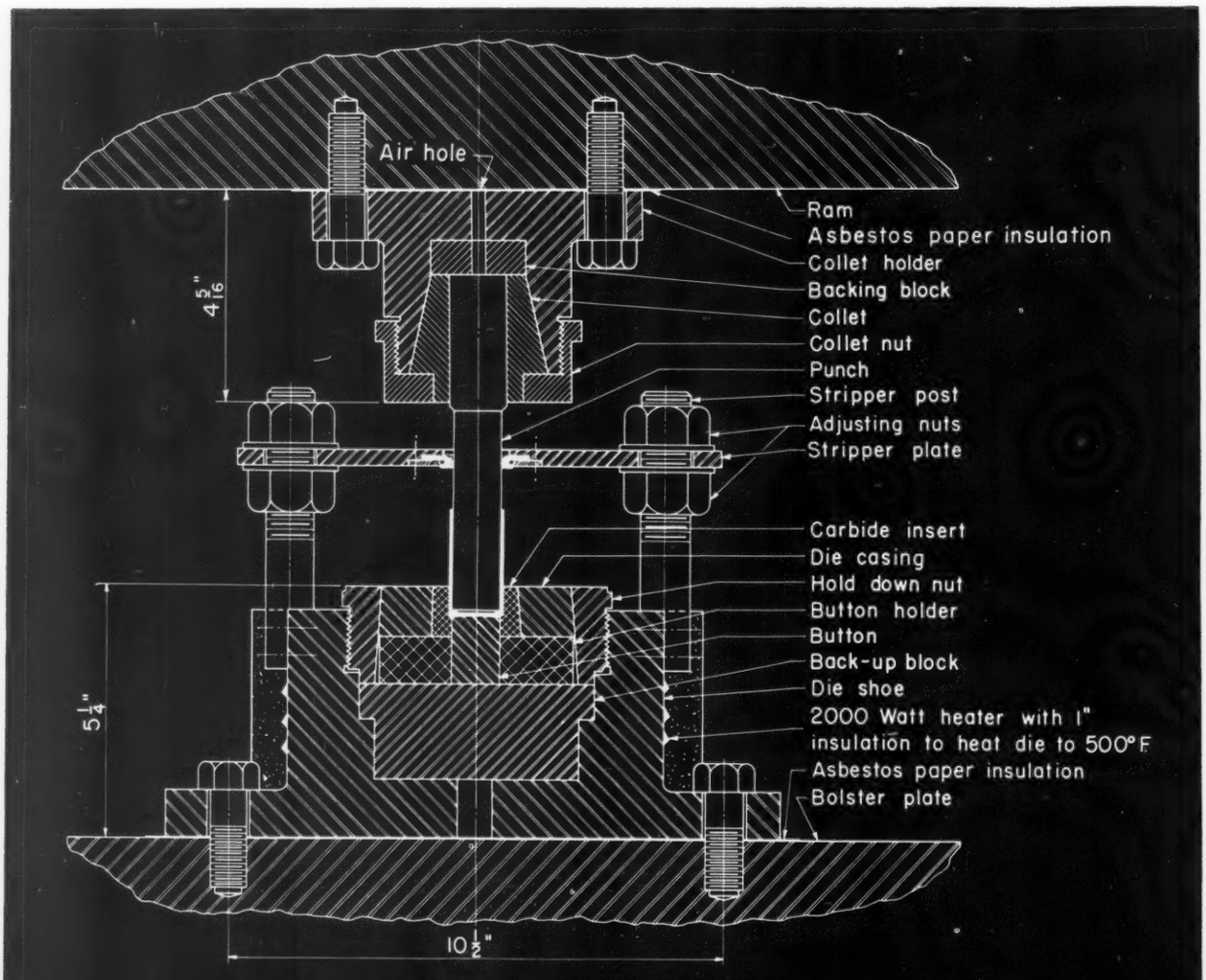


Fig. 1. Impact-extruded magnesium battery cans ranging in diameter from about 7/16 inch to 1 1/4 inches and in length from 1 to 6 inches. Blanks used are shown in front of each can

movement of the jaws as the punch moves up and down in operation. Spring pressure keeps the jaws closed to prevent passage of the work. As a result of the taper in the die, a slight taper is produced in the wall of the part. In cases where wall thickness tolerances do not permit this, the die walls have to be straight. Then the parts stay in the die and a knock-out is needed.

The depth of the die cavity is determined by the size of the slug used. A small radius at the

Fig. 2. Assembly diagram of punch and die employed for the impact extrusion of the magnesium battery can shown in Fig. 3



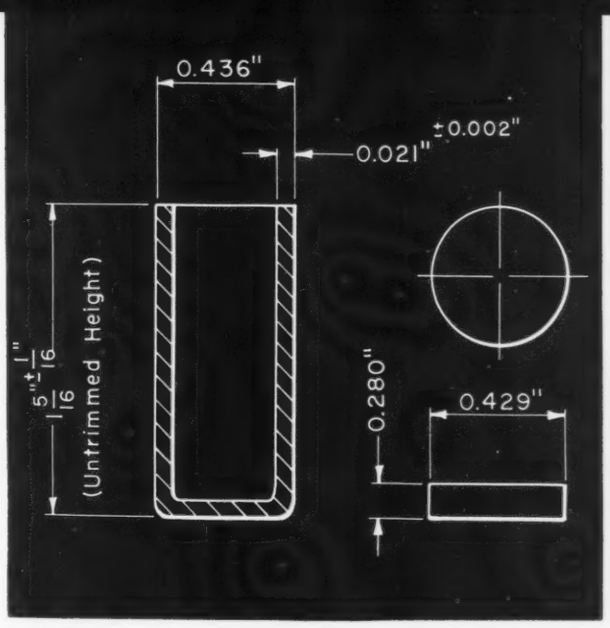


Fig. 3. Typical impact extrusion and the magnesium blank from which it is made. Blank thickness is equal to volume of part divided by bottom area of cup

top of the die facilitates entry of the punch, and the corner radius at the bottom is small enough to produce a part that is practically square. A hardened and ground tool-steel die button is used at the bottom of carbide die inserts. It will be noticed in Fig. 6 that a 1-degree cone is provided at the end of this button, which forms the bottom of the die. This facilitates the flow of metal as the slug is compressed by the punch.

Unless it is desired to have a thick rim or flange around the top of the finished part, the slug from which it is made must not project above the die cavity. Usually the depth of the cavity is greater than the slug thickness by 1/8 inch. The thickness of a slug for any given part is based on the volume of material required in the part. That is, the slug thickness equals the volume of the part divided by the bottom area of the cup. If an allowance must be made for trimming the part, about 1/16 inch should be added to its height.

The die diameter is made 0.008 inch per inch larger than the desired finished part dimension to allow for expansion and contraction of the magnesium at the die temperature of 500 degrees F. The punch diameter is made only 0.004 inch per inch larger than the desired finished part dimension.

It will be noticed that the carbide insert shown in Fig. 6 is 0.005 inch longer than the tool-steel casing, in which it is a shrink fit. This provides space, in the assembly, for the casing to move as the result of the bending moment produced by the compressive forces acting in the die.

The die is surrounded by a resistance coil in operation to provide heat at a temperature of 500 degrees F., and a thermocouple is employed to insure accurate measurement of this operating temperature. A suitable hole is provided in the casing for the thermocouple.

The method of heating the die may be seen in the heading illustration and in Fig. 7, where a typical press set-up is shown. In this automatic set-up, consisting of a hopper, heated feed track and a transfer mechanism, the slugs are heated to the required temperature as they pass through the feed track.

The tubular heater through which the feed track passes is made by winding nichrome wire on an alundum core and applying an alundum refractory cement and a coat of insulation. The excellent thermal properties of magnesium permit the use of a smaller heater than would be required for other metals such as steel or zinc. A 1750-watt heater, 39 inches long, is used to heat slugs 0.429 inch diameter by 0.280 inch thick. This produces temperatures up to 800 degrees F. If slugs were processed at seventy-five per min-

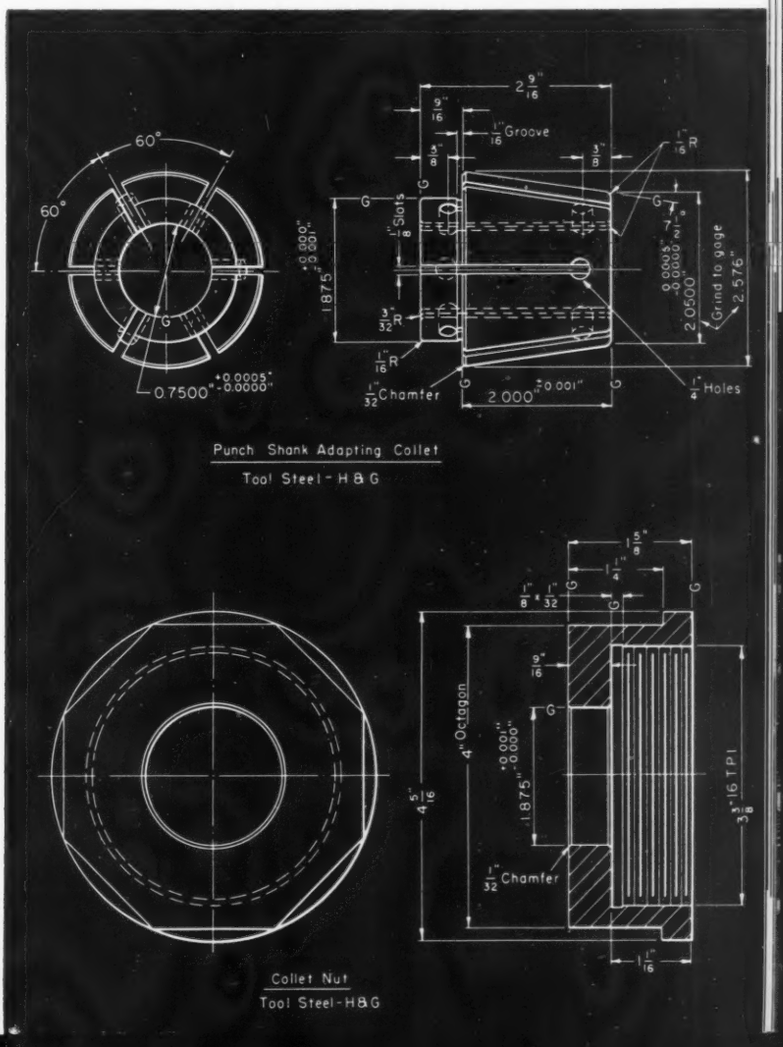


Fig. 4. Details of the punch-holder collet and nut employed in the assembly illustrated in Fig. 2. These tools are designed to accommodate a range of three different punch sizes

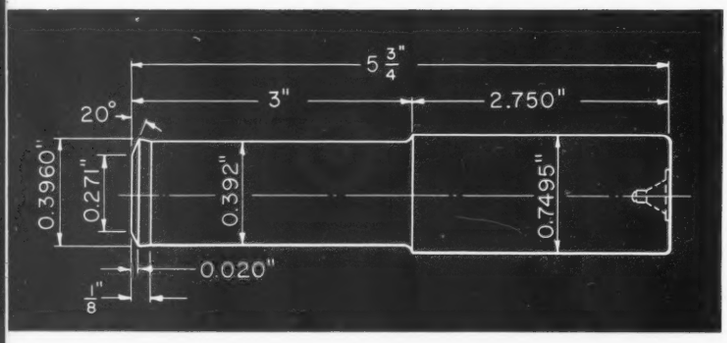
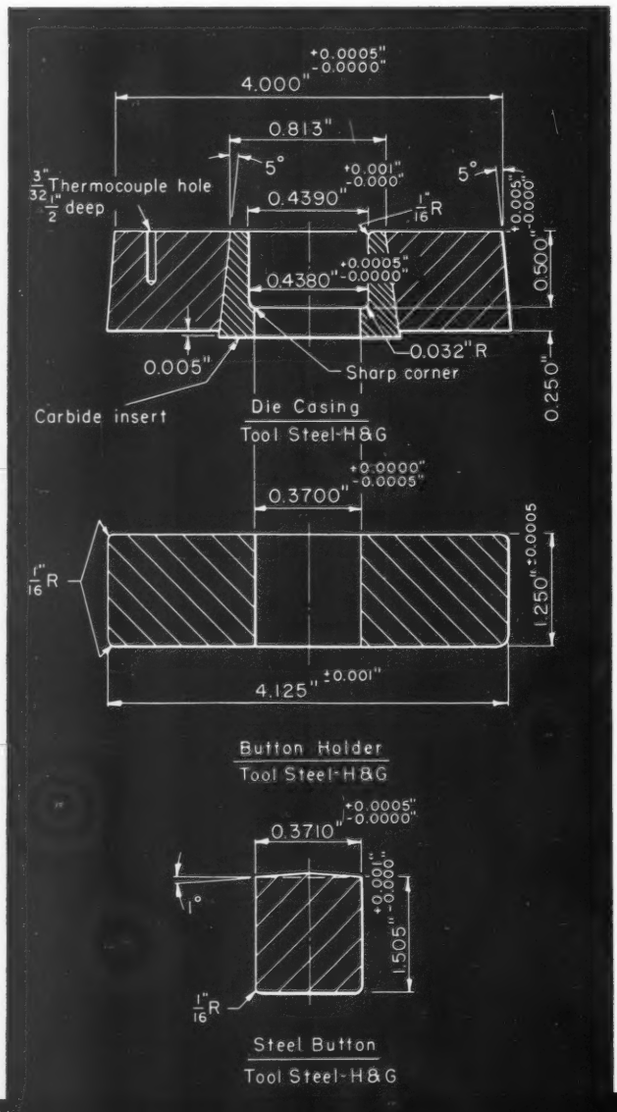


Fig. 5. Punch used in the impact extrusion of the magnesium battery can illustrated in Fig. 3. The 20-degree bevel at the nib end facilitates the flow of metal in the extruding operation

ute through this heater, they would be heated to 500 degrees F. in approximately 1 1/4 minutes.

Other conventional methods of heating—for example, high-frequency induction or direct flame—could be used if conditions warranted. When small orders are processed, the parts are heated on a platen heater and transferred to the die cavity with tongs.

Horizontal or hydraulic presses can also be used for the impact extrusion operation. The equipment chosen depends largely on preference or on what is already available in the shop. Some presses may have certain advantages over others, but, in general, any sturdy, well guided press with sufficient capacity and stroke is acceptable.



Horizontal presses provide easier feeding and ejection of parts, but the slide ways show wear faster than on a vertical press.

Close tolerances are held by careful alignment of the tools, short punches, perfect alignment of the press ram, small clearances between the slug and die, and proper slug lubrication. Plus or minus 10 per cent of the nominal wall thickness of a part is considered a good production tolerance. The bottom thickness tolerance is usually plus or minus 0.005 inch. In starting with a cold punch, the expansion of the punch due to heating must be considered in holding this tolerance.

When a small number of parts are to be made, hand-feeding may be desirable, but for high production runs, automatic equipment is used. The automatic set-up shown in the heading illustration produces parts at the rate of 40 per minute. The upper limit at which parts can be made has not been reached as far as extrudability is concerned. Some parts have been made on presses operating at 100 strokes per minute. The limiting factor would appear to be a suitable feeding mechanism, rather than the press speed.

The pressure required for magnesium impact extrusions varies with temperature, reduction in area of part, alloy, and lubricant used. A pressure of 40 to 45 tons per square inch is needed for the impact extrusion of Dowmetal FS alloy with a reduction in area of 85 per cent. The necessary pressure drops considerably as the operating temperature is increased up to 700 degrees F., but the tendency for die loading and scoring of parts increases. Pressures do not vary much for reductions in area below 85 per cent, but above this amount, especially above 90 per cent, the required pressure increases very rapidly. The per cent reduction in area is equal to:

$$100 \times \left(1 - \frac{\text{cross-sectional area of part}}{\text{cross-sectional area of blank}} \right)$$

There are indications that the lubricant used may cause a variation in the pressure necessary, and the shape of the slug may also cause some variations in pressure requirements. For instance, a square slug needs slightly less pressure

Fig. 6. Details of die assembly shown in Fig. 2. The carbide insert extends 0.005 inch beyond the casing to provide space in the assembly for a slight movement of the casing during extruding operation

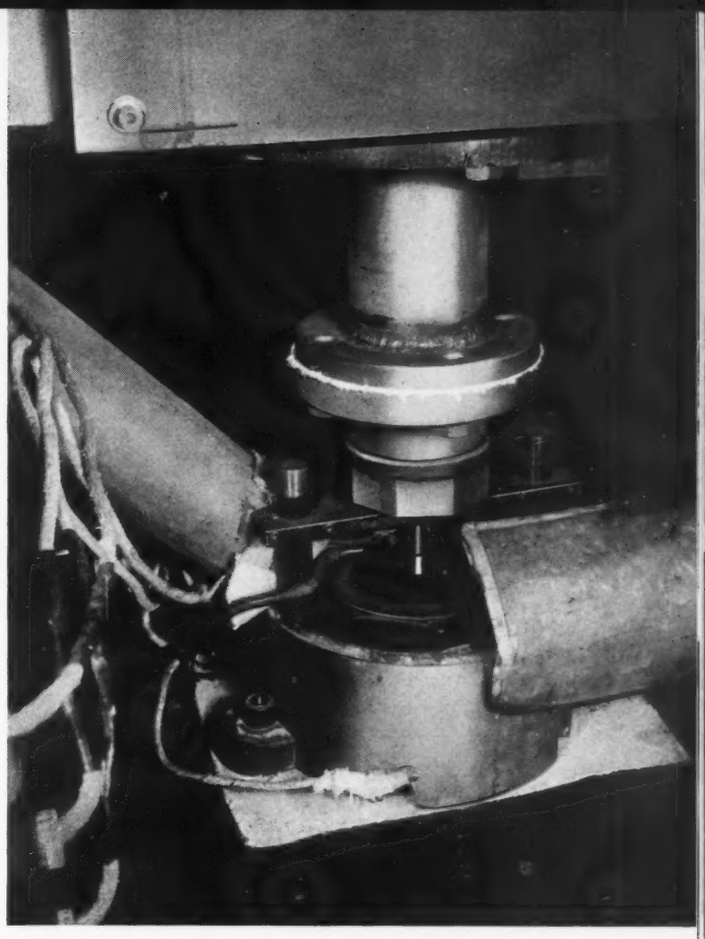


Fig. 7. The impact extrusion die used for making the part shown in Fig. 3 is heated to 500 degrees F. by means of a 1750-watt heater, which is surrounded by insulation 1 inch thick

to extrude than a round slug when a die having a round cavity is used. However, lubrication and wear problems are more severe when square slugs are employed in round-cavity dies.

In making slugs, it is important that the relation between the slug diameter and the die diameter be carefully considered. The slug must be centered in the die cavity to make parts of uniform wall thickness. If too much clearance between the slug and the die is allowed, the slug may be placed off center in the die cavity, allowing a greater metal flow on one side of the punch. If the punch has any tendency to bend, this condition will cause it to be pushed over to one side, thus resulting in the production of eccentric parts. Therefore, it is recommended that the slug diameter be made as close to the die diameter as possible.

The rate at which the slugs must be fed to the die cavity may control the allowable difference in slug and die diameters, but in most cases, 0.010 inch at the operating temperature is allowed on magnesium slugs. In some instances, it may be necessary to use preformed or pierced slugs to help center the punch. This method is generally used in making collapsible tubes.

Lubricant is applied to the slugs by tumbling. Several graphite dispersions have been used for this purpose, but "Dag 41," made by Acheson Colloids Corporation, has given highly satisfactory results. This material has been used, as purchased, at a rate as low as 1 cubic centimeter per 100 square inches of slug surface for parts impact-extruded in a carbide die. On a production job, 2000 slugs, 0.429 inch in diameter by 0.275 inch thick, have been uniformly coated by tumbling about ten minutes in a closed container with only 10 cubic centimeters of lubricant added to the slugs. If open containers are used, about two parts of a suitable carrier must be added to thin the colloidal graphite

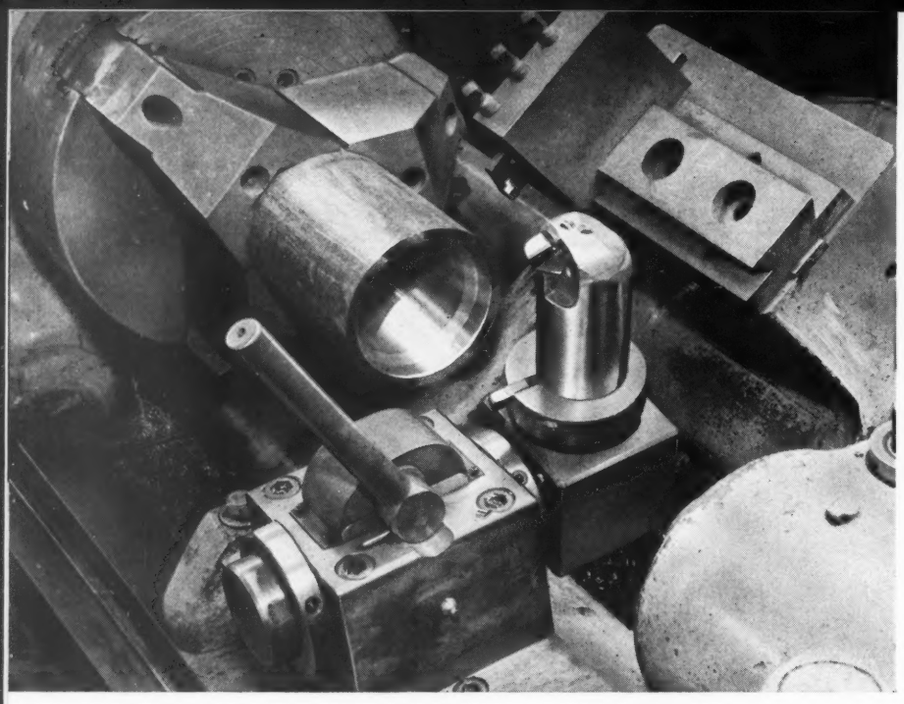
It is very important that the lubricant film be controlled if good quality parts are to be obtained. Too much or too little lubricant will result in poor quality parts, causing the magnesium to adhere to the die cavity surfaces, with subsequent scoring of the parts. Likewise, if the lubricant film is uneven or left off part of the slug, seizure or welding of the magnesium to the die cavity surfaces will occur. This will result in non-uniformity of wall thickness in the extruded parts. In addition to this defect, the surface produced from the unlubricated part of the slug will have small checks or cracks similar to a cold-short surface.

Other methods of lubrication that have been used successfully are spraying the lubricant on the die or spraying the heated slugs. When this is done, the "Dag 41" colloidal graphite is usually thinned with five to ten parts of kerosene to one part of concentrate. Obviously, these methods are too slow for high-speed automatic operation. A thin, even film has never been attained by dipping the slugs in the lubricant.

If the slugs are likely to be handled roughly, it is advisable to bake the lubricated slugs for one-half hour at 800 degrees F. to increase the adhesion of the lubricant to the magnesium surface. It may also be necessary to clean them by pickling prior to applying the lubricant film in cases where the rod or slugs have been allowed to oxidize or pick up oil, dirt, metal dust in tumbling, or other foreign matter.

A corrosion problem arises when graphite is applied to magnesium; therefore, the slugs should not be coated and allowed to stand unless they are stored in closed containers. It is best to lubricate them just prior to the impact extrusion operation.

The information on impact extrusion tools and methods described in this article is based on a paper presented before the Magnesium Association by T. L. Patton of the Dow Chemical Co., and on information supplied by M. S. Andrews of the Independent Tool & Die Corporation.



Special on

AN ingenious method of tooling automatic lathes has increased the production of drill pipe tool joints for oil-well equipment at the American Iron & Machine Works Co., Oklahoma City, Okla. Internal and external contours are quickly and accurately machined in semi-finished forgings by using special boring-bar attachments and cam-bars, or formers, to direct the travel of the cutting tools.

An idea of some of the operations performed in this shop on a 20-inch Fay automatic lathe will be obtained by referring to the cross-sectional view of three typical parts in Fig. 2. The work on the part shown at *A* consists of facing the end of the forging, counterboring the face and bottom where threads are later milled, and chamfering the inside diameter.

As the carriage travel of this machine was too short to permit moving a boring-bar of suitable length out of the way of the chuck during loading

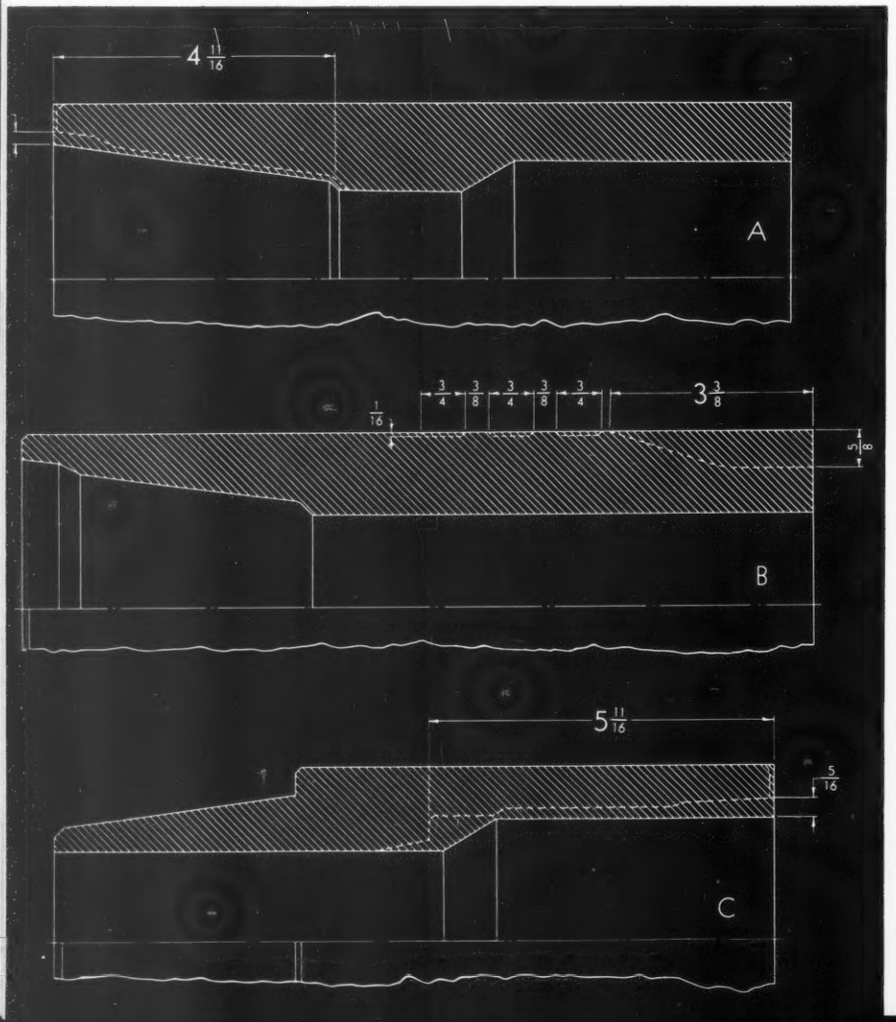


Fig. 1. (Upper Left) Special boring attachment shown in position for loading and unloading the chuck of a Fay automatic lathe used in machining a forging as indicated at (A) in Fig. 2

Fig. 2. In view (A), dotted lines indicate the contour boring operation performed on a semi-finished forging in the automatic lathe shown in Fig. 1. Other typical operations accomplished in automatic lathes with special tooling are indicated at (B) and (C)

Tooling Speeds Operations Automatic Turret Lathes

By A. E. RYAN, Shop Superintendent
American Iron & Machine Works Co.
Oklahoma City, Okla.

and unloading, a special boring attachment was made. This can be tilted through an angle of 90 degrees for loading and unloading the chuck, as shown in Fig. 1. The attachment is mounted on the lathe carriage in the same manner as a standard tool-holder used for external turning, and it is locked in position by means of a quick-acting cam-clamp.

In the tooling lay-out, Fig. 3, it can be seen that a cam-bar mounted on the front slide of the machine moves the carriage as required to obtain the desired contour in the work. The cam-bar, like the carriage, can be moved longitudinally, so that it can be positioned in the proper relation to the work. The cams that actuate the front former slide on this machine are so made as to relieve the cutting tool pressure, thereby avoiding under-cutting at the end of the cut and during the return stroke, so as to prevent scoring. The return stroke is fast, and the machine stops automatically at the end of its work cycle. As a result of these advantages, a floor-to-floor production time of 3 to 4 1/2 minutes, depending upon the size of the part, is attained.

Another job for which a special set-up is employed in a Fay automatic lathe is illustrated in Fig. 4. This part requires turning and tapering of the outer periphery, as well as machining of three grooves in which carbide bands are later installed. The taper and the turned sections are

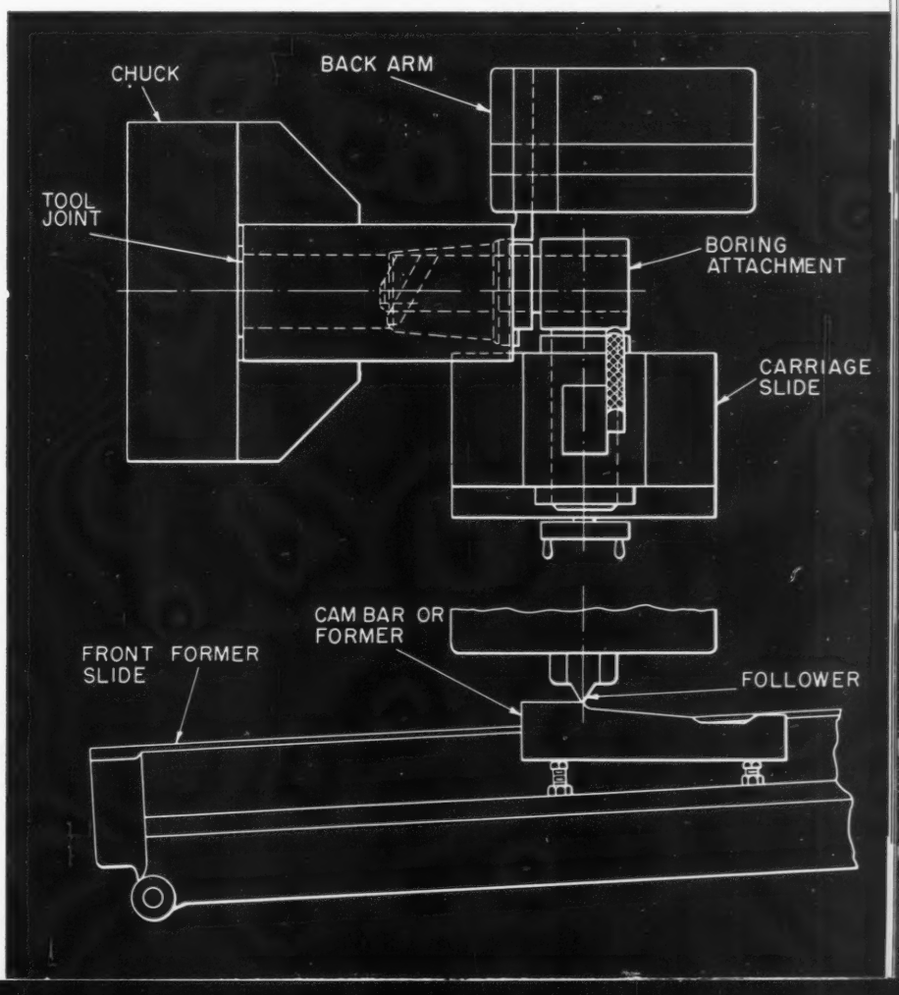


Fig. 3. Tooling lay-out for facing, counterboring, and chamfering the forging illustrated at (A) Fig. 2. It will be noted that a cam-bar, or former, is used to produce the required contour in the bore

produced with an ordinary single-point tool held in the toolpost on the front slide. As may be seen in the foreground of Fig. 5, a cam-bar is employed to obtain the required contour.

Three back-arms are used for the grooving operation to stagger the load imposed by the three tools. As seen in Fig. 6, which shows the rear of the lathe, the formers that move the back-arms are positioned to actuate them progressively. By operating the arms in sequence, only one grooving tool is cutting at one time. The floor-to-floor time for turning, tapering, and grooving is 3 to 3 1/2 minutes for each part.

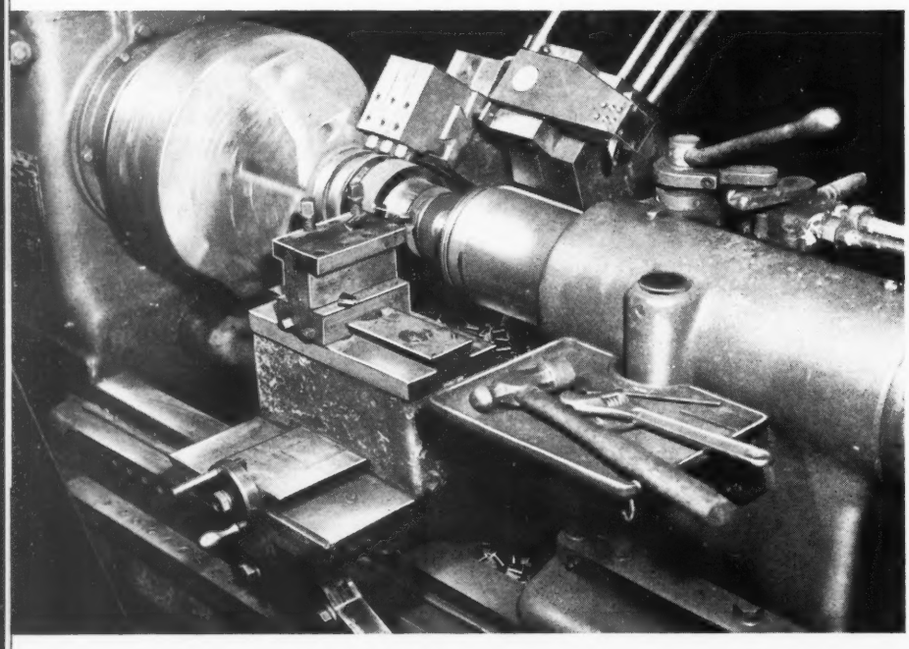


Fig. 4. (Upper Left) This forging is turned, tapered, and grooved in an automatic lathe in 3 to 3 1/2 minutes, floor-to-floor time

Fig. 5. The grooving tools are mounted in special back-arms, designed to stagger the load imposed by the three tools. The cam-bar for taper-turning is seen in lower foreground

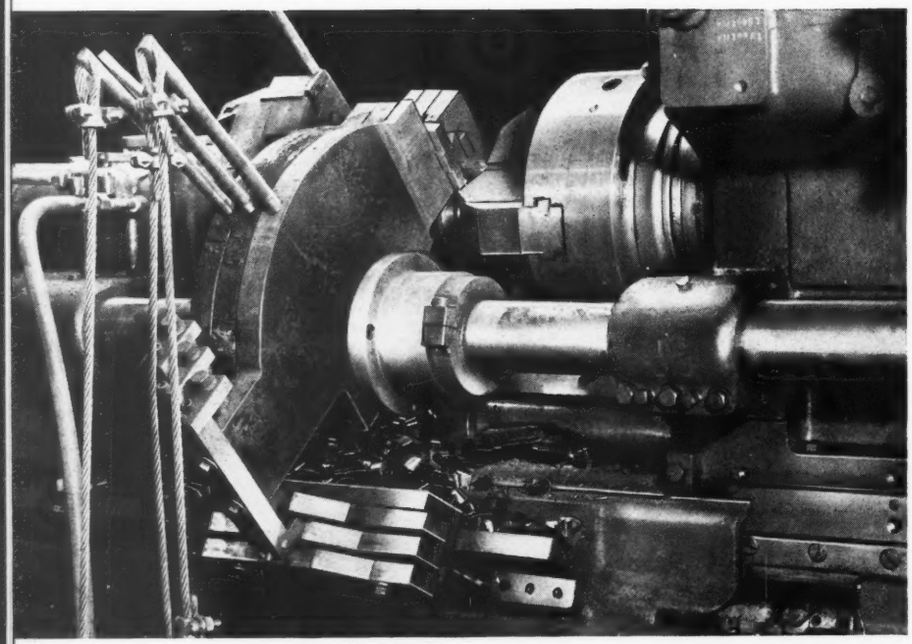


Fig. 6. Rear of Fay automatic lathe, showing special back-arms and formers arranged to actuate grooving tools progressively

Another application of formers on these automatic lathes is illustrated in Figs. 7 and 8. The one shown in Fig. 7 actuates the tools illustrated in Fig. 8 for taper-turning the ends of the pins seen in Fig. 9. In addition to turning a taper on the periphery of the work, the operation includes facing the shoulder and the end, as well as chamfering the bore. The appearance of the work following these operations is shown in Fig. 9. The pins are later thread-milled.

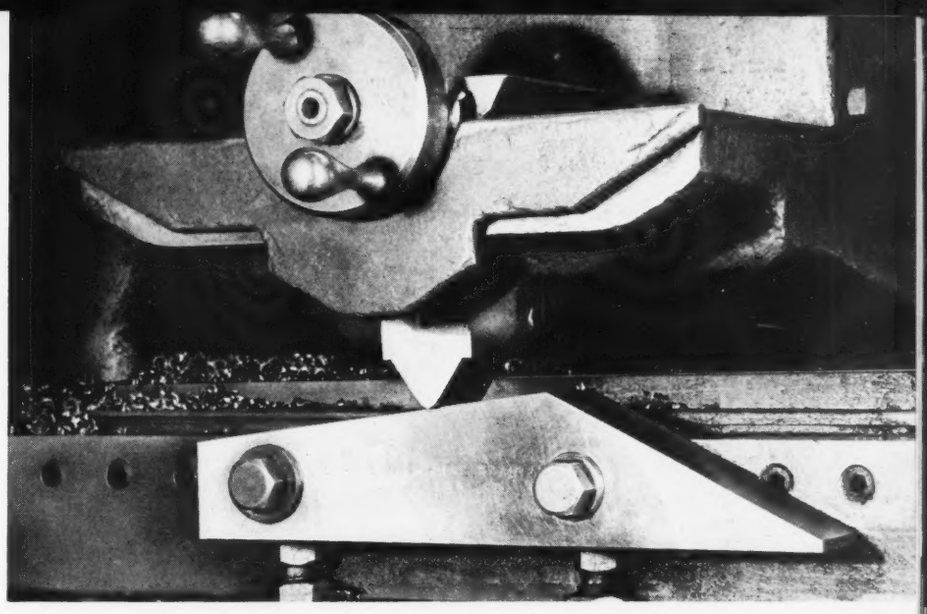


Fig. 7. (Upper Right) Cam-bar or former used on Fay automatic lathe for taper-turning, facing, and chamfering operations

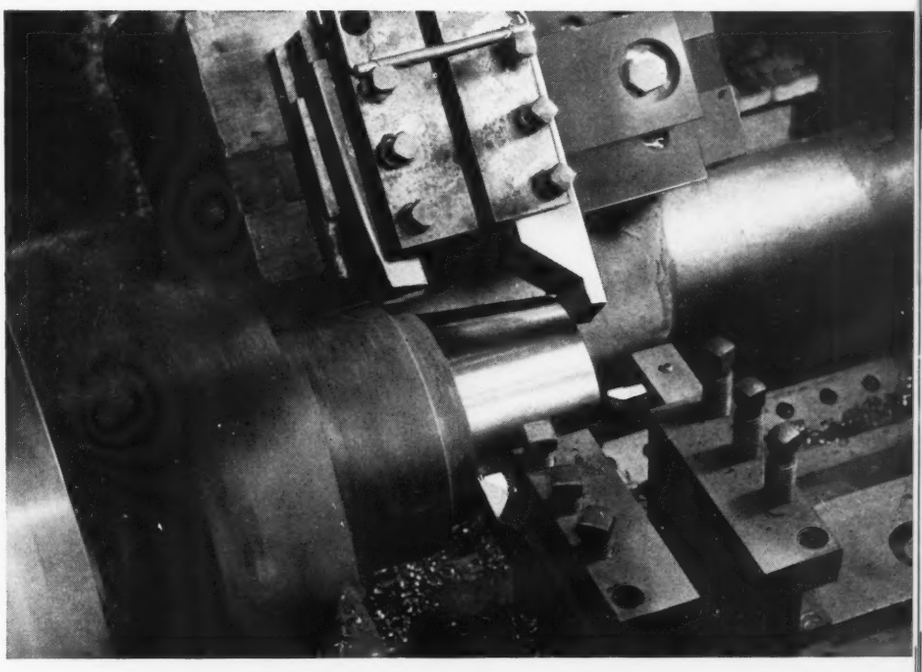
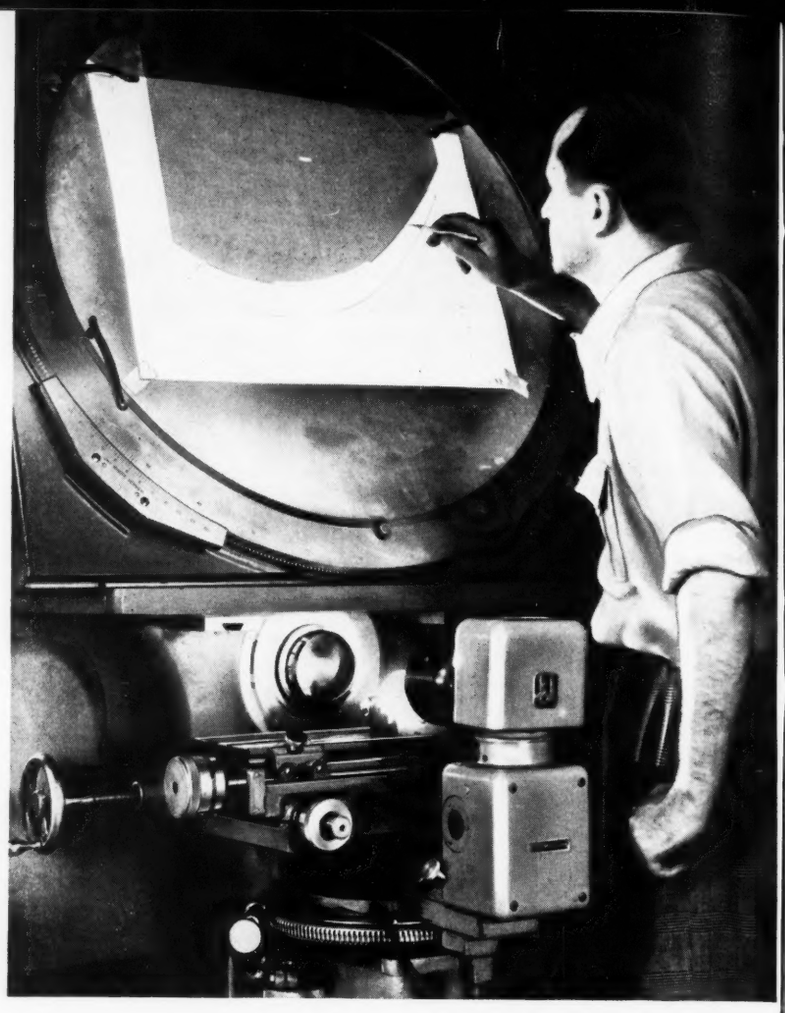


Fig. 8. Tools actuated by the former shown in Fig. 7 for operations performed on the ends of the pins illustrated in Fig. 9

Fig. 9. A group of pins as they appear after being machined in an automatic lathe. They are subsequently thread-milled

Because of the High Rotating Speed of Turbine Buckets and the Elevated Temperatures in which They Operate, It is Essential that the Various Elements of Each Blade—the Airfoil Form, the Root, and Other Sections—be in Exact Relationship to One Another. Some of the Gages Used to Insure This are Described Here



Precision Gages for Jet-Engine Turbine Buckets

By
EDWARD J. PIRNER, General Manager
Daco Machine & Tool Co., Brooklyn, N. Y.

THE inspection of jet-engine turbine buckets has presented a serious problem to the aircraft industry because of the difficulty of quickly and accurately checking airfoil contours, the angle of twist in the blade, centrality and lean of the airfoil section in relation to the root, angular relationship between the curve of the blade and the root, and other important design characteristics. A high degree of accuracy is obviously essential in these relationships, since turbine buckets must operate efficiently while subjected to temperatures in the range of 1400 to 1600 degrees F. and centrifugal forces of approximately 30,000 pounds per square inch. Thermal stresses, varying atmosphere, corrosion, vibration, and differential expansion of materials must all be met.

To check aircraft gas-turbine buckets, one of which is shown in Fig. 1, so that they will be certain to meet these conditions in operation, the Daco Machine & Tool Co., Brooklyn, N. Y., is building gages for the Ranger Engine Division, Fairchild Engine & Airplane Corporation, that can be operated quickly and accurately. One of these gages, used for checking the angle of the root, or spline, of a bucket relative to the chord of the airfoil section, is shown in Fig. 2. This angle is 2 degrees 30 minutes, and must be held to within plus or minus 30 minutes.

The jaw blocks *A* and *B*, Fig. 3, by which a bucket is held in the gage at the spline, or root, are broached in the same machine and with the same broach as are used for producing the splines in the turbine wheels in which the buckets are later assembled. This insures obtaining exactly the same fir-tree pattern in the gage as in the turbine wheels. The jaws are mounted on supports on a platen *C*, which moves on ball bearings, thus permitting the bucket to float and move in a direction parallel to the axis of the spline.

A blade *D*, or gage-plate, made to suit one section of the airfoil contour, as will be described later, is mounted on a bellcrank arm *E*. Arm *E* swivels on ball bearings, the center of the pivot action being aligned with the vertical center line of the jaws. This combination of movements permits the gage-plate to move radially and the platen to centralize the bucket relative to the gage-plate. When the gage-plate is swiveled to mate with the contour of the bucket, a reading is obtained from the dial block *F*, which is graduated in increments of one-half degree. This gaging operation is simply and accurately performed by the use of a hand-grip *G* and a finger-grip *H* after clamping the work in the jaws.

The method of producing the airfoil contour in the gage-plate in accordance with one section along the axis of the bucket is especially interesting. The first step is to make a master template by laying out the contour on a brass plate, using a 10 to 1 enlargement ratio. For this operation, the plate is placed in a jig boring machine and a series of holes is produced according to the desired contour, as shown in Fig. 4. After contour sawing to remove the scrap end of the plate, the work is filed to within 0.001 inch of the nominal contour.

A piece of oil-hardening ground stock is then laid out in the same manner, except, of course, that no enlargement is made, and the form is milled to within 0.015 inch of the nominal contour, Fig. 5. The milled work is hardened to 60 to 62 Rockwell C, after which it is placed in a Studer contour grinder, Fig. 6, together with the master template.

The platen on which the work is clamped reciprocates vertically to present the full thickness of the part to the wheel. At the same time, the wheel follows the contour of the template, this movement being controlled by a stylus which the operator moves along the template. Pantograph arms between the stylus and the grinding wheel spindle reduce the amount of movement in the ratio of 10 to 1. Thus an accuracy of 0.0001 inch is achieved in producing the desired form in the work, the template having been made accurate to within 0.001 inch.

After rough- and finish-grinding, the contour of the gage-plate is checked on a comparator as shown in the heading illustration. Here a mask having the airfoil form laid out ten times greater than actual size is placed on the comparator screen. The work is held in a table fixture, or stage, in front of a lamp, which magnifies its image on the screen in the ratio of 10 to 1. By visually comparing the image of the work with the contour of the mask, a close check on the accuracy of the form is obtained.

Another interesting gage is used for checking the location of a slot in the root of the bucket relative to the theoretical axis of the blade section. The accurate location of this slot is of importance in the operation of a turbine wheel, since each bucket is individually fastened to the wheel by a key passing through this slot. This distributes the resistance to centrifugal force uniformly over all the blades, no one, or group, being dependent upon the fastening of the others.

This slot and key, in combination with the fir-tree pattern at the bucket root, provides a method of fastening the buckets that has the advantages of strength, low stress concentration, and ease of replacement in the field. The location of the slot relative to the theoretical axis of the blade section is maintained within 0.008 inch. However, because this location cannot actually be measured so far as a theoretical axis is concerned, the airfoil contour at two sections of the blade is checked in this gage and the relationship

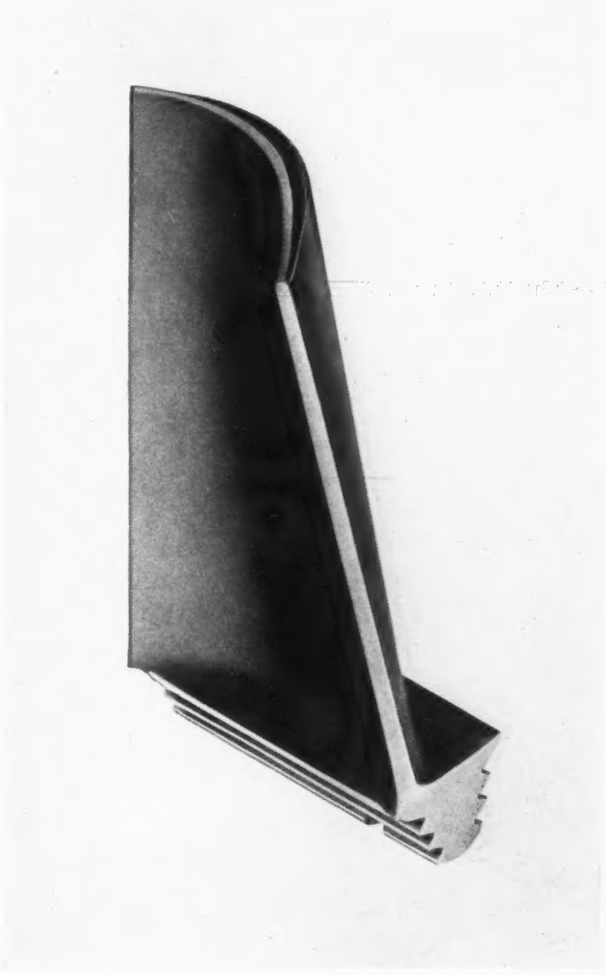


Fig. 1. Typical aircraft jet-engine turbine bucket requiring precise gaging to insure efficiency in operation

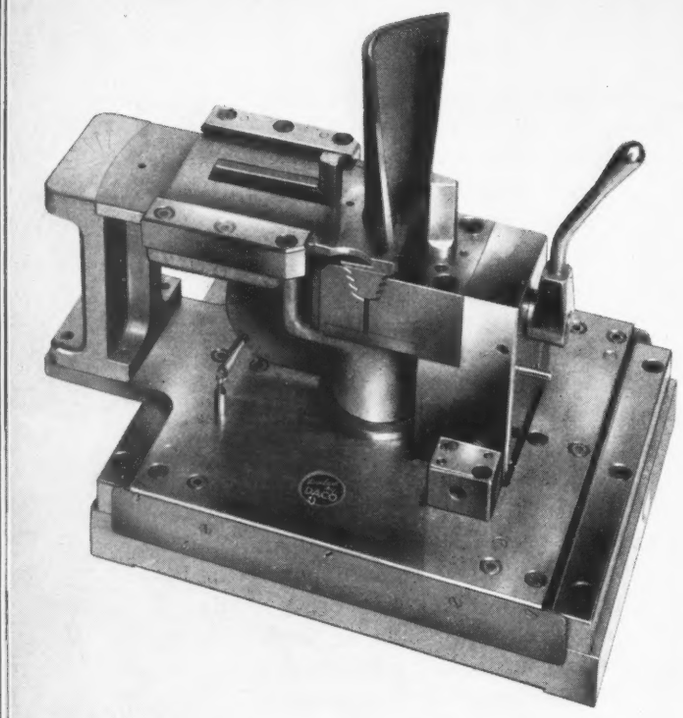


Fig. 2. Gage for checking the angle of a turbine bucket root relative to the chord of the airfoil section

of these sections to the theoretical axis is established by a master gage, as will be described later.

In operation, a swinging clamp-block *A* (see Fig. 7) holds a bucket at the airfoil section against two gaging blades *B* and *C*, which are formed in accordance with the contour of two stages of the airfoil section of the bucket, while the root rests on a locating arm *D*, shaped to fit into one of the grooves of the fir-tree pattern.

The arm *D* is hinged, so that it can be raised or lowered to engage the V-shaped groove in the bucket, regardless of permissible variations in the groove width. The locating arm is so mounted that it is also free to move in the direction of the groove axis, thus allowing for variations in the straightness of the V-groove. Directly under the center of the formed edge of arm *D* is a pivot *E*, which is centrally aligned with the bucket groove. The locating arm is swiveled on this pivot to bring it into parallel alignment with the axis of the groove. In this position, the bucket is located in the gage longitudinally, and the airfoil contours that match blades *B* and *C* are in alignment.

A dial indicator *F*, mounted at one side of the locating arm, has its contact point abutting against the surface of the gage-block *G*. The gage-block is free to move in a direction parallel with the axis of the bucket root. The indicator is set to zero by means of a master gage. This is done by moving the gage-block *G* until the spring-loaded pin *H* engages the slot in the root. The reading thus obtained should not exceed 0.008 inch.

The head of the master gage (upper right, Fig. 7) is made with a groove and a slot similar to those in the bucket root. This groove and slot are located within a tolerance of plus or minus 0.0001 inch. There is a removable gage-pin *J* in the master gage, located at right angles to the axis of the groove. The groove axis is at an angle of 2 1/2 degrees relative to the pin, which corresponds to the relation between the theoretical axis of the blade section of a bucket and the root.

The master gage is set up with the groove positioned in the locating arm *D* and pin *J* a sliding fit in holes *K* and *L* provided in the blades *B* and *C*. The master gage is fitted to a 2.450-inch dimension across blades *B* and *C* to a high degree of accuracy for squareness and parallelism. Pin *E* is then engaged with the slot in the head of

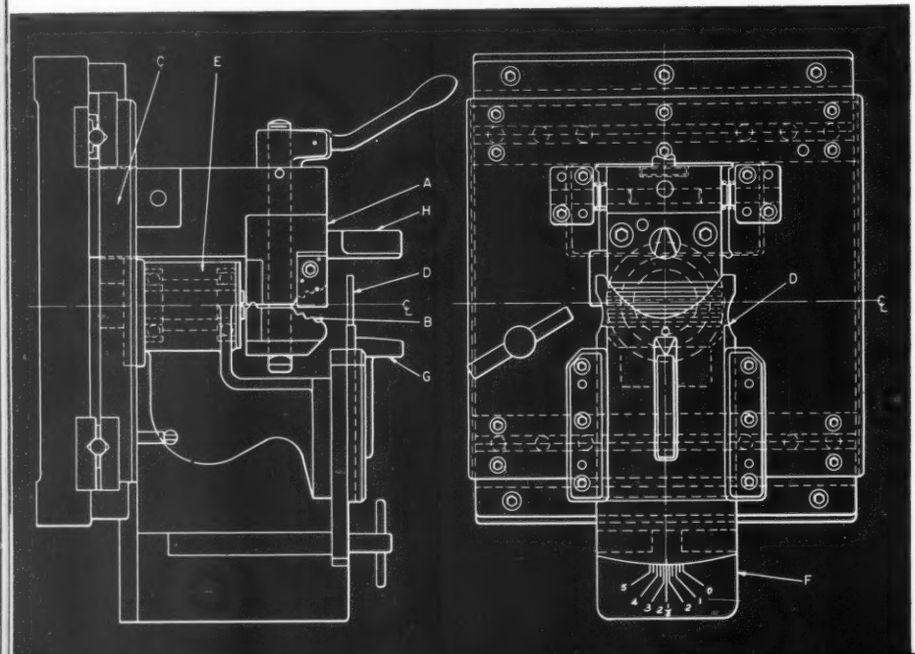


Fig. 3. Assembly drawing and details of gage shown in Fig. 2. The bucket is held in jaws, while a gage-plate is mated with the airfoil contour to check angular relationship of root with blade section

Fig. 4. Using a jig boring machine to produce holes in accordance with the outline of the airfoil contour at one stage of a bucket blade to produce a template used in form-grinding a gage-plate for the gage illustrated in Fig. 3

the master gage by moving the gage-block *G*, after which the dial indicator is set to zero.

It can be seen that this design eliminates the need of form-ground plates in the master gage, since the gage-pin *J* (corresponding to the theoretical axis of the blade section of a bucket) and the groove in the head of the master gage place the gage-block *G* in the same relation with the gage slot as it has with the slot in the bucket roots.

Conventional machining and grinding methods were followed in making these two gages, the form-ground blades *B* and *C* being made in the manner previously described. The location holes *K* and *L* were jig-bored in each piece, as were the construction and dowel holes. After the blades had been hardened to 60 to 62 Rockwell C, they were ground and all of the holes jig-ground to within a location tolerance of 0.0001 inch.

The gage illustrated in Fig. 8 is used to check the centrality and lean of the blade section of a bucket relative to the root. The theoretical center line of the blade axis must be central with the root within 1 degree (or 0.070 inch in a length of 4 inches).

In this gage, the bucket is clamped and held at the root in jaws *A*, Fig. 9, the end of the blade section being supported on a pin *B*. The jaws are closed and opened by a quick-acting toggle-clamp *C*, which moves a tapered jaw slide *D* backward or forward on gibs. The jaws, which have carbide wear strips, move on guides *E* in a straight line toward and away from each other. Four gage wires in the jaws engage two grooves in each side of the bucket root. One set of wires is free to move into the grooves to insure full engagement, regardless of slight variations in groove size arising from form tolerances.

The jaw assembly is mounted on a cross-slide *F*, by means of which the unit is moved under dial indicators after a bucket has been clamped in place. One of the indicators *G* is mounted on a stationary arm *H*. This indicator has a standard contact point which is depressed by the ver-

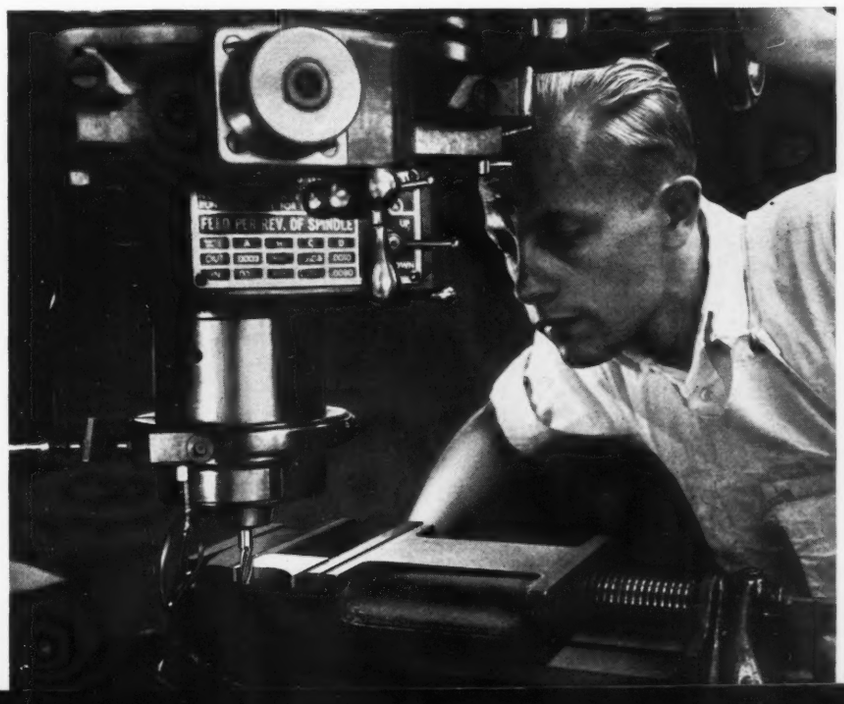


Fig. 5. Contour-milling a gage-plate that is used in the gage illustrated in Figs. 2 and 3 prior to performing the hardening and form-grinding operations

Fig. 6. Form-grinding a gage-plate by the use of a 10 to 1 template that has a contour corresponding to the form of one of the stages of a bucket blade

tical movement of a holder in which the second indicator *K* is supported. The holder has a knife-edged indicator plate at the end under indicator *G*. Thus, when this plate is raised by contact with the airfoil form of a bucket, a reading near the root end of the blade section is obtained.

At the same time, indicator *K* is raised by the movement of its holder, and a second reading is obtained by the depression of its tapered point in contact with the extending second stage, 2.450 inches away from the first stage. Comparison of these two indicator readings gives the amount of lean of the blade with reference to the root between the two stages of the blade.

Centrality of the blade section of the bucket is obtained in the same set-up, since the bucket root in the gage jaws is in axial alignment with the theoretical axis of the blade section under the indicators. A master bucket (upper right, Fig. 9) is used for setting up the gage. This master has a form-ground root similar to that of a bucket, but is rectangular in shape at the blade section. The gaging surfaces of the rectangular end are ground flat, parallel, and symmetrical about the theoretical axis, so that it is possible to maintain an indicator reading within 0.0001 inch over the entire area.

When the master bucket is held in the jaws, the dial indicators are in contact with the flat, rectangular section and a zero reading is obtained. The symmetry of the master is such that when it is rotated through an angle of 180 degrees, to present the opposite side to the indicators, the zero reading is maintained. This use of a master establishes the proper position of the indicators for gaging the buckets.

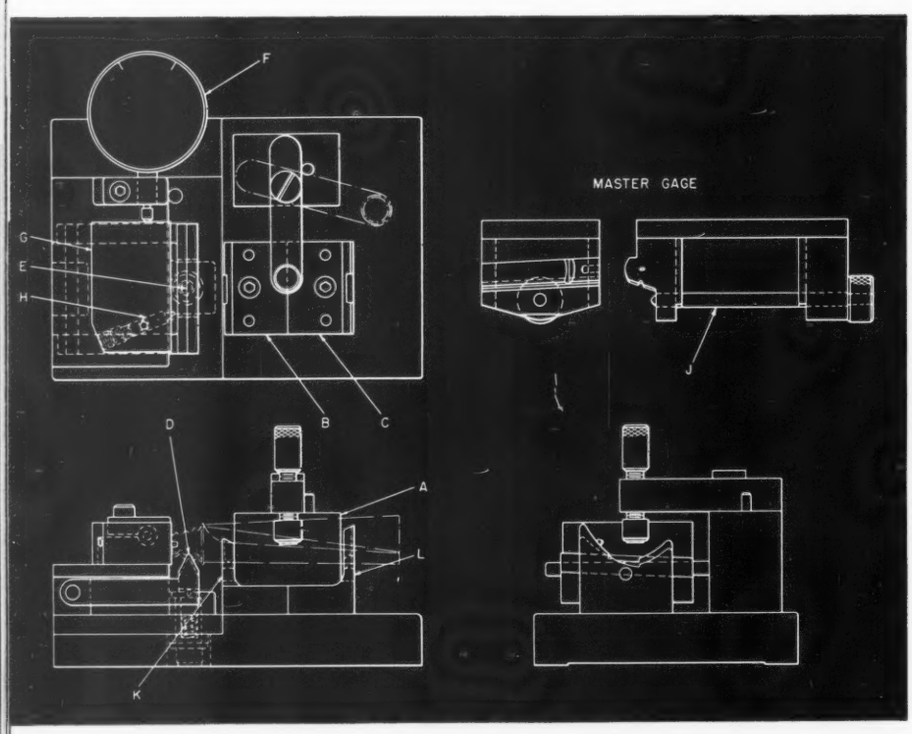
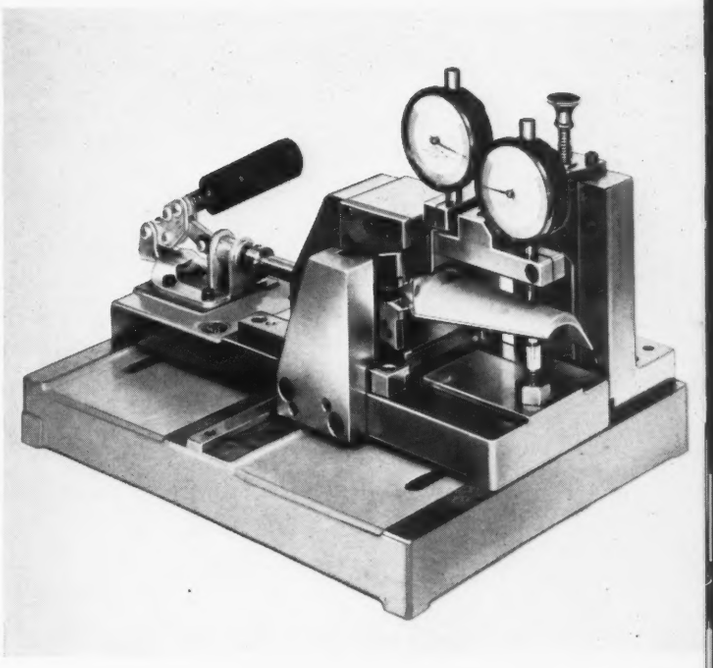


Fig. 7. Drawing showing design of gage used for checking the location of a slot in the root of a turbine bucket relative to theoretical axis of blade section

Fig. 8. Gage for checking the centrality and lean of the blade section of a bucket relative to the root. The theoretical axis of the blade must be central with the root within 1 degree



In making the master gage, the root end is form-ground on a surface grinder, using a diamond-dressed wheel. The wheel-dressing operation is performed with a Moore "Panto-Crush" wheel-dresser that combines roll-crushing and diamond-dressing facilities. For diamond dressing, a template ten times the size of the work is made in the manner previously described. Since the template is made to within 0.001 inch of the nominal form, the wheel is dressed within 0.0001 inch of the desired contour.

The form-ground carbide inserts in the jaws of the gage required careful attention. Before grinding, these inserts were brazed to hardened jaw blocks in which construction holes were accurately located. Since the form is made up of compound angles resulting from the 2 1/2-degree angle in one plane and the root form in another, the construction holes make it possible to produce the form in the carbide with diamond wheels employing a "Magna-Sine" chuck on a surface grinder.

In designing all of these gages, consideration had to be given to keeping the surface of the work free from scratches and other marks. Thus none of the gages is made so that the buckets slide into the gaging position. In all cases, the contacting members, indicators, gage blades, etc., move up and down into contact with gaging points on the buckets.

Another point that had to be considered in the gage design was the relatively liberal tolerances allowed in the construction of the forged buckets. This made it necessary to design the gages so that the theoretical axis of the blade section was always used as a reference, and the relationship of the polished airfoil contour with this axis was employed as the actual gaging surface. In use, these gages considerably speed the inspection of jet-engine turbine buckets.

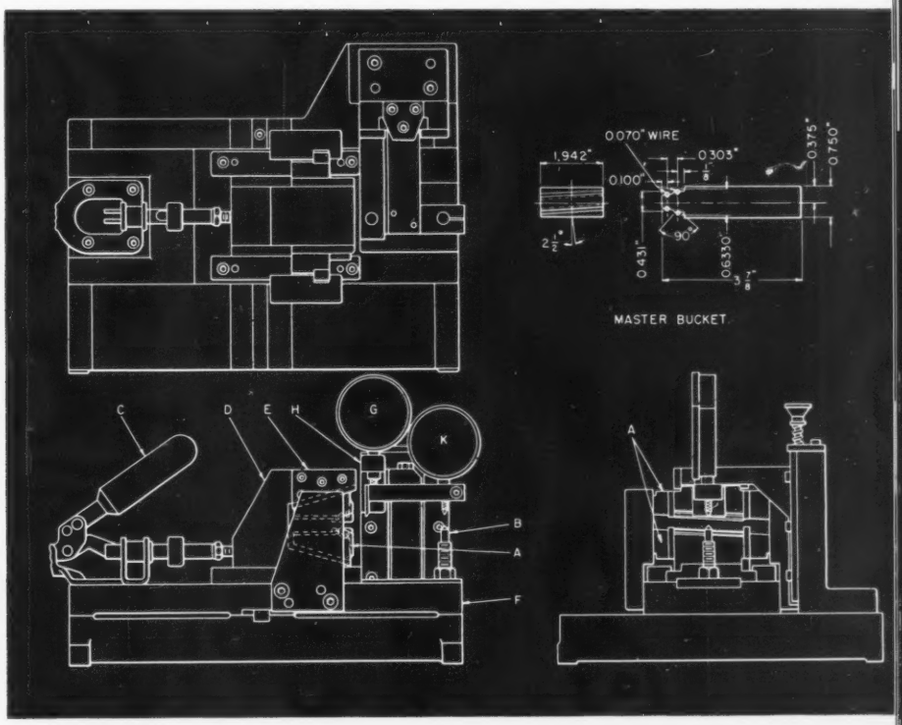
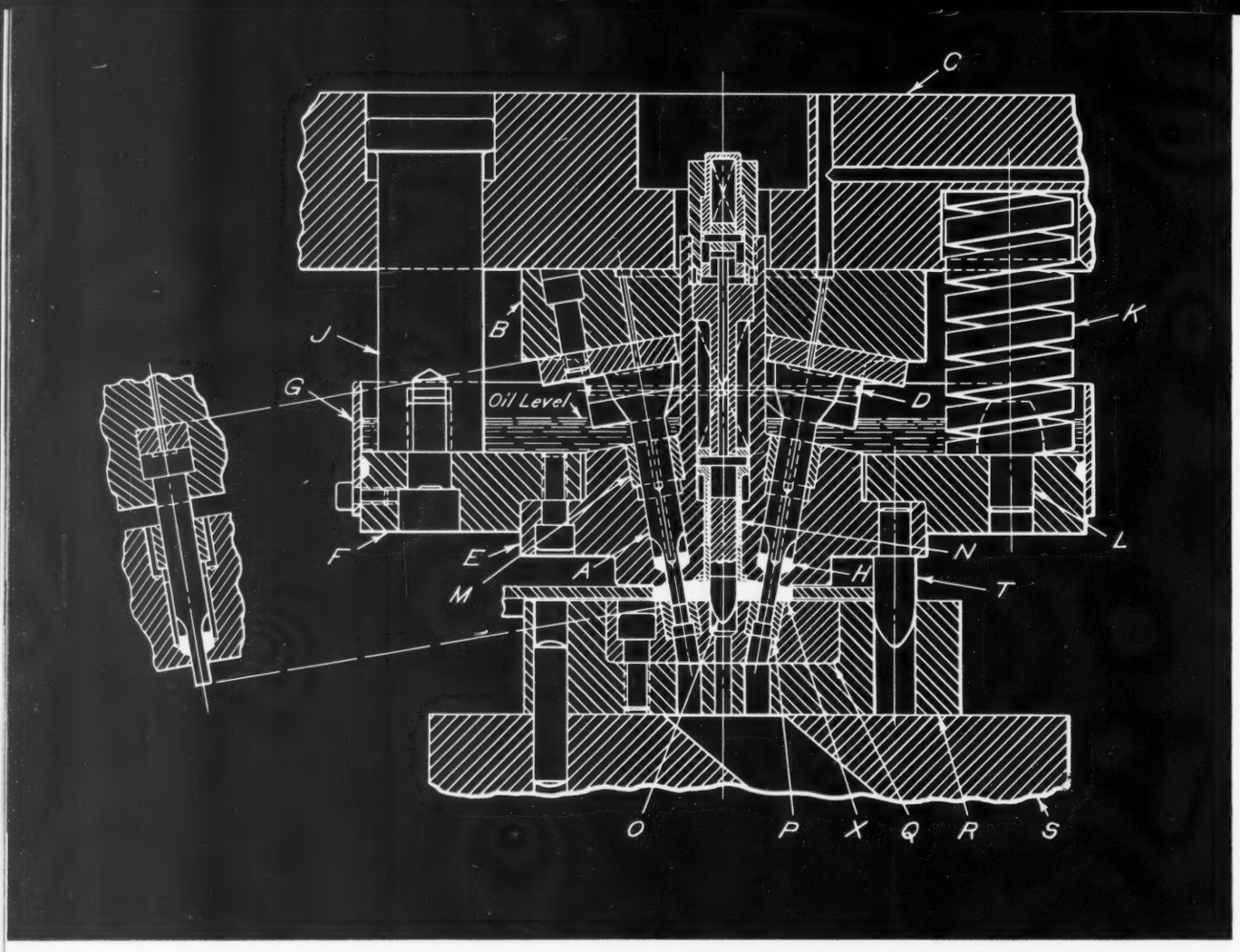


Fig. 9. Gage that gives comparative readings between two stages of airfoil contour of a bucket blade section to determine centrality and lean of blade



ONE of our most effective anti-tank weapons in the Korean conflict is the 3.5-inch rocket, which is fired from light-weight, portable bazookas. An important component of the rocket is the so-called "trap" that controls the escape of propellent gases. The cadmium-plated steel traps, approximately 1 7/8 inches in diameter and 9/32 inch thick, contain twenty-one holes ranging from 7/32 to 3/8 inch in diameter.

When the Oldsmobile Division of General Motors Corporation was awarded an Ordnance contract for the mass production of this important type of ammunition, a comprehensive study was made of existing methods of manufacturing the rocket parts. In the case of the gas traps, it was found that an improved product could be obtained with fewer operations and at higher production rates by piercing the twenty-one holes in the thick blanks instead of drilling them, as was the conventional practice. The line-up of presses used for producing these parts is seen in Fig. 1.

In this unique production set-up, the traps are blanked from cold-finished flat steel (SAE 1040) bars, 2.25 inches wide by 0.281 inch thick, and from 10 to 14 feet long. Although the rough blanks are only 1.850 inches in diameter, the full 2.25-inch width of the bars is used to provide two 0.406 inch wide diametrically opposite tabs on the periphery of each blank. These tabs are used to locate the blanks in subsequent piercing operations. A centrally located hole is pierced in the same operation, using a punch 0.296 inch in diameter and a die 0.318 inch in diameter to provide the necessary clearance. A trap blank is shown at *A* in Fig. 2.

Blanking, tab-forming, and piercing are all performed on the Minster 56-ton press illustrated in Fig. 3. The flat steel bar is fed manually against a stop, and a positive knock-out with air ejection is provided for the die. The press operates at forty-five strokes per minute on this operation.

Following these press operations, the trap blanks are annealed to minimize punch breakage and increase the life of the dies used in subsequent operations. Annealing is accomplished in a Leeds & Northrup Homo tempering furnace. The reason for annealing the blanks rather than the long flat bars prior to blanking is that the large equipment necessary for heating the bars was not available, and, with the present method, the edges of the blanks are softened.

The annealed blanks are coined on a Minster 400-ton press operating at 36 strokes per minute. In coining, a 10 degree angular face is formed on one side of the blank, as seen at *B* in Fig. 2. The diameter of the blank is increased from

Unique Dies Pierce Gas Traps for 3.5-Inch Rockets

By
DONALD H. SMITH
Oldsmobile Division
General Motors Corporation
Lansing, Mich.

1.850 to 1.940 inches in this operation, while the dimension over the tabs (2.25 inches) remains the same.

A sliding type manual loader is provided on the press, the locating tabs on the trap blank fitting into a nest on the loading plate. When the plate is slid into the die area and the press ram starts to descend, a pilot-pin in the upper die enters the previously pierced bore to centralize the blank. As the ram rises, the operator returns the slide to the loading position and an air cylinder automatically ejects the part onto a gravity slide leading to the next press. If no part is ejected from the die area, a solenoid arrangement prevents the press from repeating its cycle until the stuck part is removed from the die.

In the next operation, the sides of the locating tabs on the trap blanks are shaved to permit more accurate location in subsequent operations. Shaving of the locating tabs is performed on a Toledo 56-ton press, Fig. 4, operated at forty-five strokes per minute. The blanks are positioned in the die area by means of a hand-slide, and are ejected from the back of the press by a blast of compressed air. Shavings drop through the die onto the bolster of the press. The shaved locating tabs have a width of 0.396 inch, and radii, where they join the periphery of the blank, of 0.047 inch.

The inner row of eight holes is pierced on a Cleveland 150-ton press, producing the part seen at *C* in Fig. 2. This press is equipped with a ten-station indexing mechanism, and has two working stations. At the first working station, four of the holes—every other one in the inner row—are pierced simultaneously with punches 0.198 inch in diameter and dies 0.213 inch in diameter. The four alternate holes in the inner row are pierced at the second working station, using punches 0.232 inch in diameter and dies 0.250 inch in diameter. The press is operated at thirty-five strokes per minute.

A plan view of the indexing mechanism used on this and subsequent presses in the gas-trap production line is shown in Fig. 5. A table top (not shown), 16 1/2 inches in diameter and containing ten locating nests for the trap blanks, is doweled and screwed to the notched indexing plate *A*. The table top and index-plate are rotated on anti-friction bearings about a vertical shaft *B* by means of a double-acting Bellows air cylinder *C*. A pin *E* in pivot-arm *D*, which is mounted on shaft *B*, engages a slot in the fitting screwed to the end of piston-rod *F*. Pivot-arm *D* carries a spring-loaded pawl *G* which over-rides the notched index-plate when the piston-rod moves to the left. During this stroke, block *H* on the pivot-arm contacts a projecting arm on the spring-loaded locking dog *J*, lifting the dog out of contact with the notch in the index-plate.

Upon continued movement of the piston-rod, pawl *G* snaps into the next notch in the index-plate, and, when the piston-rod returns to the right, rotates the plate and table top one-tenth of a revolution in a counter-clockwise direction. A spring-loaded brake-shoe *K* serves to limit the speed of rotation, and a second spring-loaded pawl *L* over-rides the index-plate, snaps into the next notch, and prevents clockwise rotation of the plate or table top.

During this return stroke of the piston-rod, a pin *M* mounted on pivot-arm *D* forces locking

dog *J* into the next notch in the index-plate. Final positioning of the table top, after indexing, is obtained by a plunger entering a bushing in the table top. A bushing is provided between each two successive nests, and the plunger is mounted above the rear of the rotary table, between the two piercing or shaving dies.

Reversal of the piston-rod is obtained by a solenoid-controlled directional air valve, which is actuated by limit switches. As the piston-rod moves to the left, when adjustable screw *N* contacts limit switch *O*, the solenoid of the air valve is energized, reversing the travel of the piston-rod. At the end of the return stroke (to the right), arm *D* contacts the spring-loaded adjustable pin *P*, thus closing limit switch *Q* and again energizing the air-valve solenoid to reverse the piston-rod.

If either switch is not closed, due to an incomplete stroke of the piston-rod, the press ram becomes inoperative. The air cylinder is equipped with a "Hydro-Check" device that offers hydraulic resistance, so as to produce a smooth, steady action on the return stroke of the piston. After the traps have been indexed past the die at the second working station, they drop through the rotary table into a chute leading to an adjacent press.

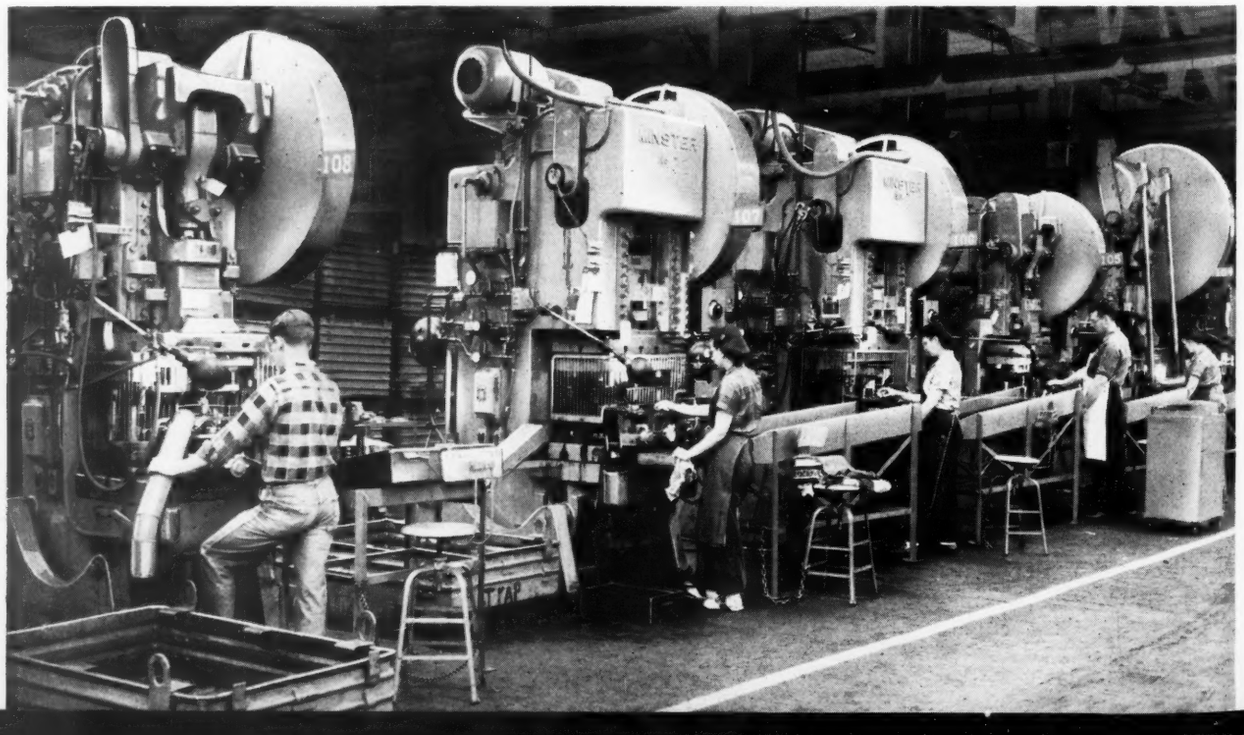
The next operation on the gas traps is performed on a Minster 56-ton press which is also equipped with a ten-station rotary indexing table and two working stations. The die at the first working station flattens the traps to remove any distortion caused in the piercing operation.

At the second working station, about 0.057 inch of stock is shaved from the center hole in the blank, producing a diameter of 0.375 inch. For shaving, the blanks are piloted on four of the holes previously pierced in the inner row, and for flattening, they are located by the center hole. The press operates at forty-five strokes per minute.

The twelve holes in the outer row of the gas trap are pierced, six at a time, on a Cleveland 150-ton press, Fig. 6, operated at thirty-five strokes per minute. This press, like the two previously referred to, is equipped with a ten-station rotary indexing table and two working stations. The traps are placed manually in nests in the rotary table as they pass around the front of the press, being located in the nests by means of the shaved tabs. When the pieces are indexed to the working stations, a pilot in each of the two upper dies enters the shaved center holes in the traps for positive location. Punches 0.232 inch in diameter and dies 0.250 inch in diameter are used for this operation. The appearance of the work at the completion of this operation is seen at *D* in Fig. 2.

A sectional drawing of one of the two six-punch dies used on this press, which is similar to the dies employed for piercing the inner row of holes, is shown in the heading illustration. In these unique dies, the sliding and reciprocating angularly mounted punches *A* are dovetailed to the under side of a punch-slide block *B*. The slide block is secured to punch-shoe *C*, which, in turn, is connected to the ram of the press. A hardened

Fig. 1. Line-up of presses employed for piercing twenty-one holes in gas-trap blanks 1.850 inches in diameter by 0.281 inch thick. The blanks are also coined, shaved, trimmed, and burnished on these machines. A sectional drawing of one of the piercing dies is seen in the heading illustration



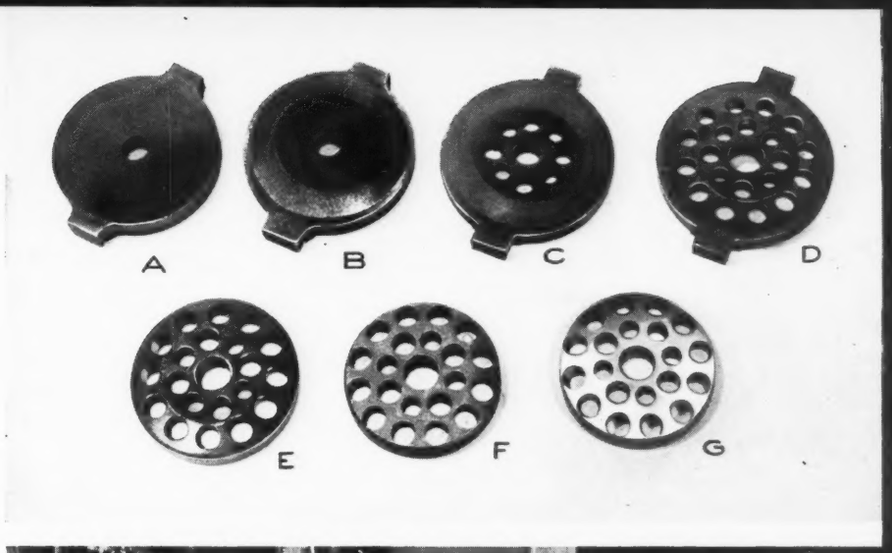


Fig. 2. Successive steps in the production of gas traps for 3.5-inch rockets. The twenty-one holes in each trap are pierced rather than drilled

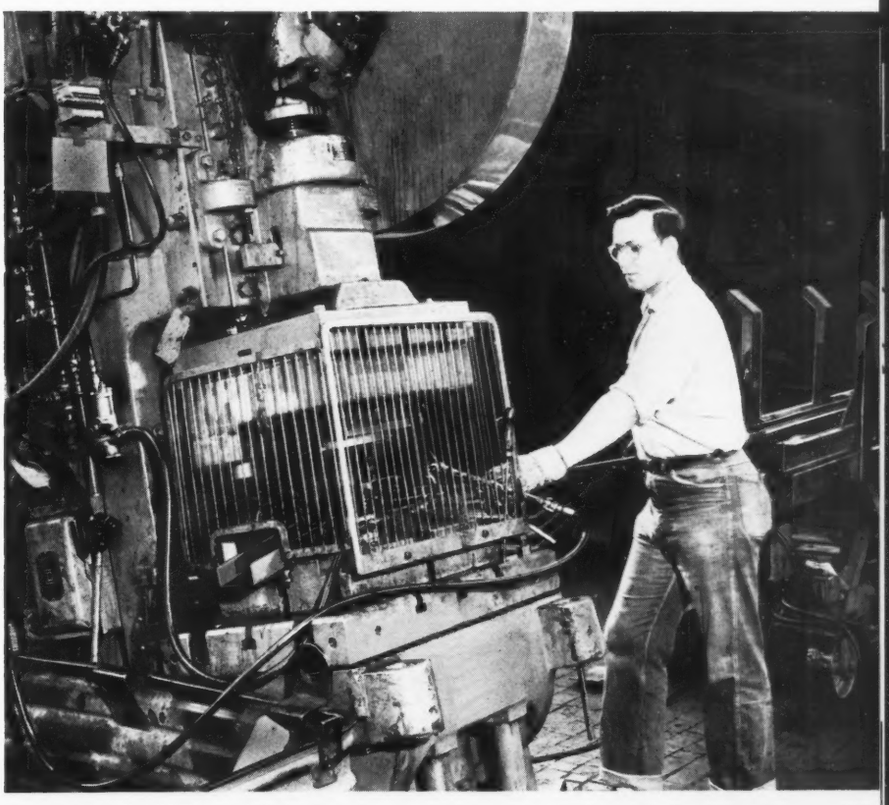


Fig. 3. Blanks, such as the one seen at (A) in Fig. 2, for the rocket gas traps are stamped from 0.281 inch thick steel bars on a 56-ton press

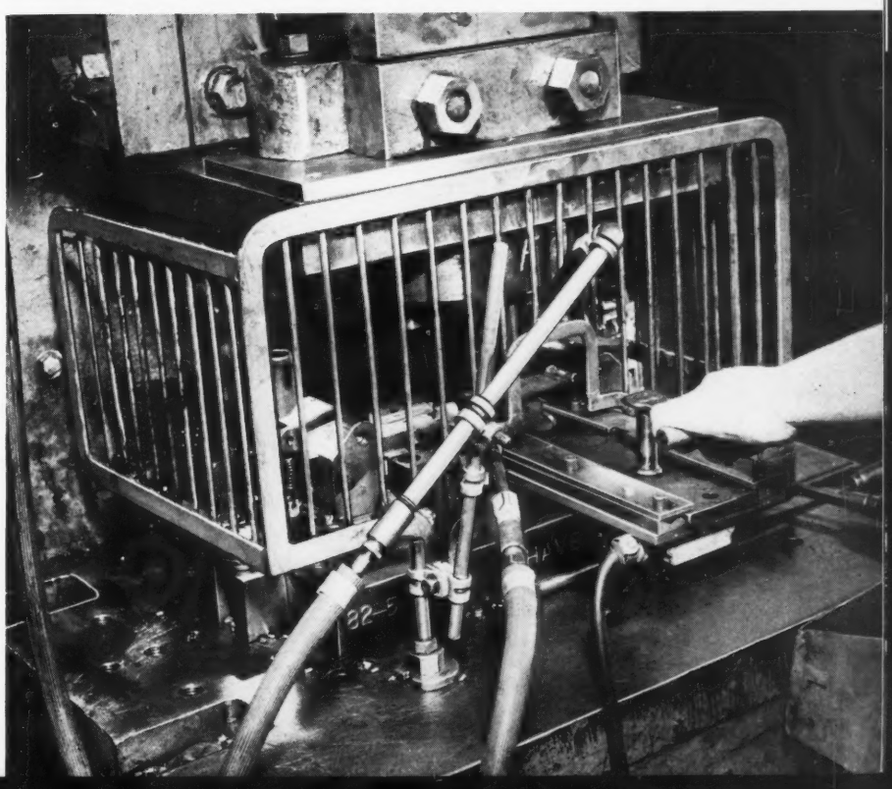


Fig. 4. Locating tabs on the gas-trap blanks are shaved to permit more accurate location in subsequent operations. This press operates at forty-five strokes per minute

and tempered music-wire split ring *D* keeps the punches from sliding out of the dovetail slots in block *B* if they are lifted out of the combination punch guide and stripper plate *E*.

Screwed to the stripper plate is an adapter ring *F*, which is equipped with ring *G* to form an oil reservoir. The reservoir is filled to the level indicated with a heavy machine oil (SAE 90W), which flows down and around the six punches and saturates the felt washers *H*, cemented to stripper plate *E*. In this way, the reciprocating punches are kept coated with a film of oil and scoring of their surfaces is prevented.

The adapter ring *F* is supported by posts *J* in punch-shoe *C*. Heavy die springs *K*, 2 inches in diameter by 5 inches long, are located in pockets in the punch-shoe and over pilots *L*, pressed into the adapter ring. These springs cause plate *E* to strip the work-piece *X* from the lower end of the punches when the press ram rises.

Bushings *M*, pressed into the upper face of the stripper plate, serve as bearings for the reciprocating punches. Mounted in the center of the plate is a spring-loaded sliding knock-out sleeve *N*, and within this sleeve is a locating pilot *O*, which enters the shaved hole in the center of the gas trap. The upper end of the pilot is connected to a limit switch by means of a pivoting lever (not shown), so that if the work-piece sticks to the pilot on the up stroke of the ram, the operation of the press will be stopped.

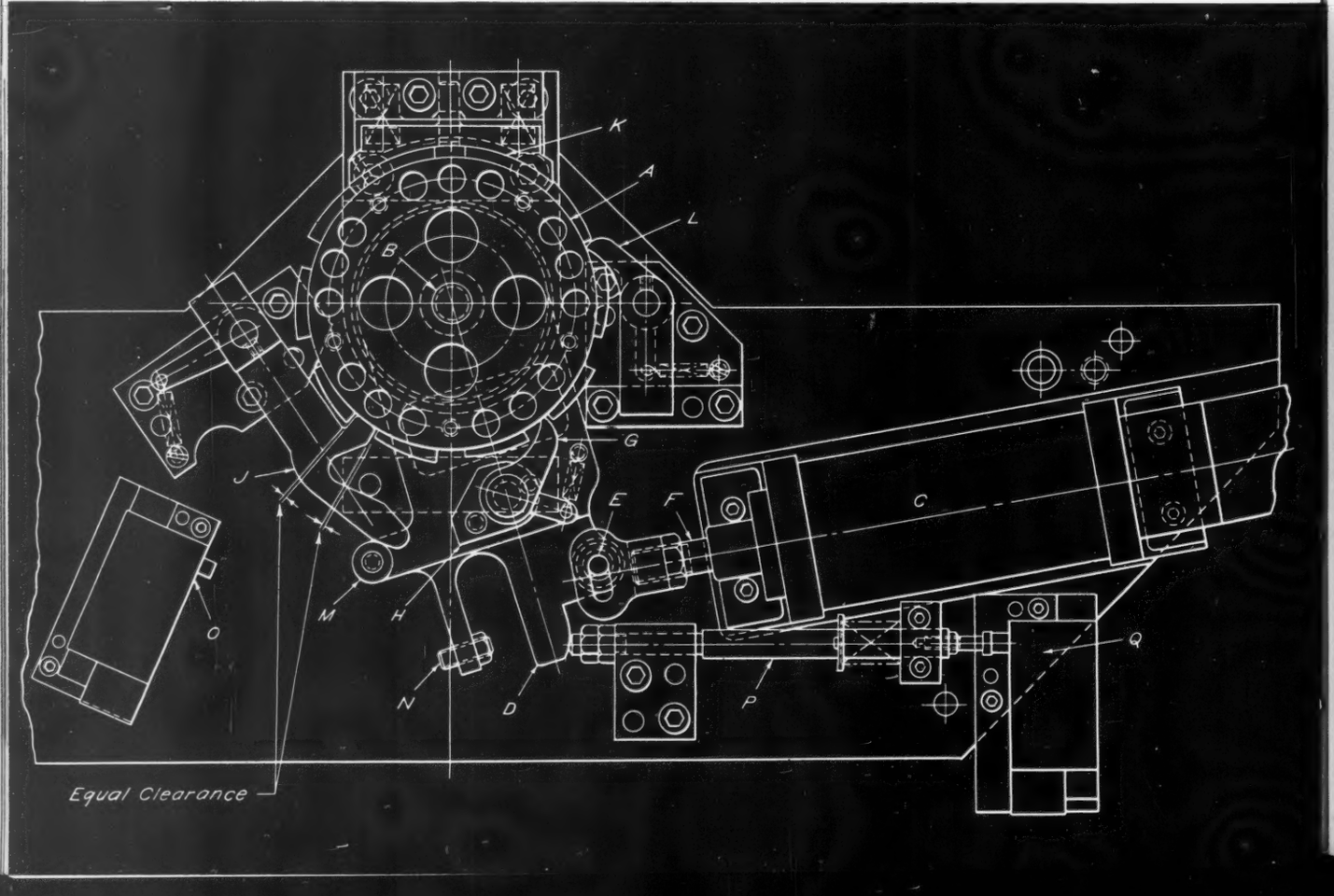
Die inserts *P* are pressed into the top face of block *Q*, which is screwed to die-holder *R*. The die-holder, in turn, is screwed and doweled to die-shoe *S*. Guide pins *T*, pressed into the under side of plate *E*, enter die-holder *R* and accurately locate the punches in relation to the work-piece.

The inner row of eight holes is shaved on a Minster 56-ton press similarly equipped to the presses just described. At the first working station, a die shaves four of the holes (previously pierced to 0.198 inch diameter). About 0.015 inch of stock is shaved from each hole to obtain a diameter of 0.213 inch. The die at the second working station shaves the other four holes in the inner row. In this case, about 0.019 inch of stock is shaved from each of these four holes (previously pierced to a 0.232 inch diameter). The press is operated at forty-five strokes per minute for this operation.

A similarly equipped Minster 75-ton press, Fig. 7, operating at the same speed, is employed to shave the outer row of holes. Again, about 0.019 inch of stock is shaved from each hole.

After flattening the traps and trimming the locating tabs on a Minster 75-ton press, all

Fig. 5. Plan view of ten-station indexing mechanism employed on several presses in gas-trap production line. The mechanism is actuated by double-acting air cylinder (C), and controlled by limit switches (O) and (Q)



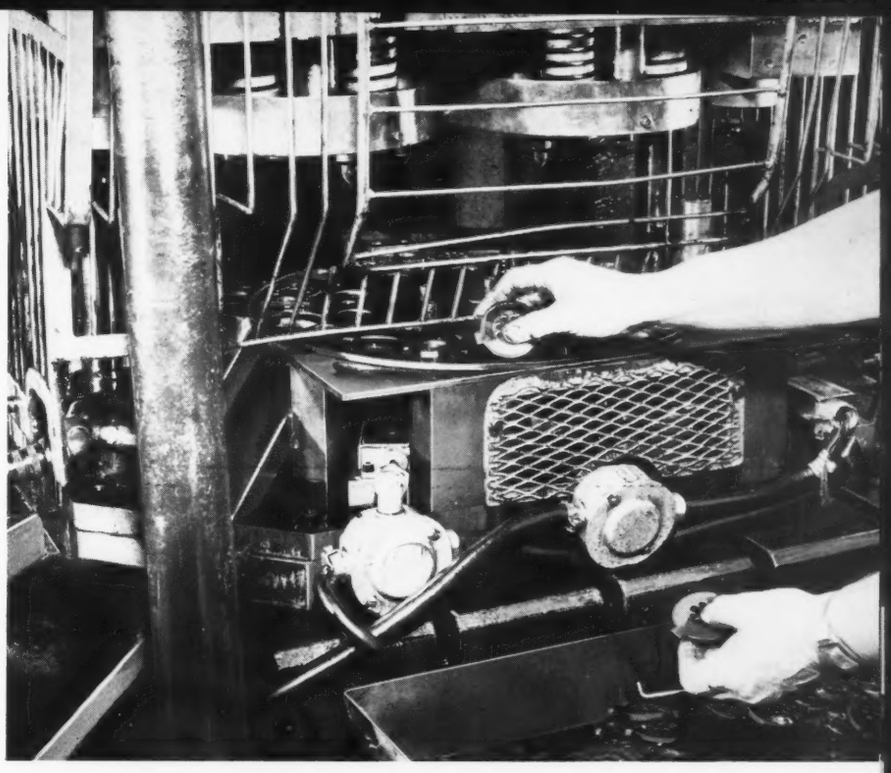


Fig. 6. A 150-ton press, operating at thirty-five strokes a minute, is employed to pierce outer row of twelve holes in each gas trap. Two six-punch dies and a ten-station indexing table are used

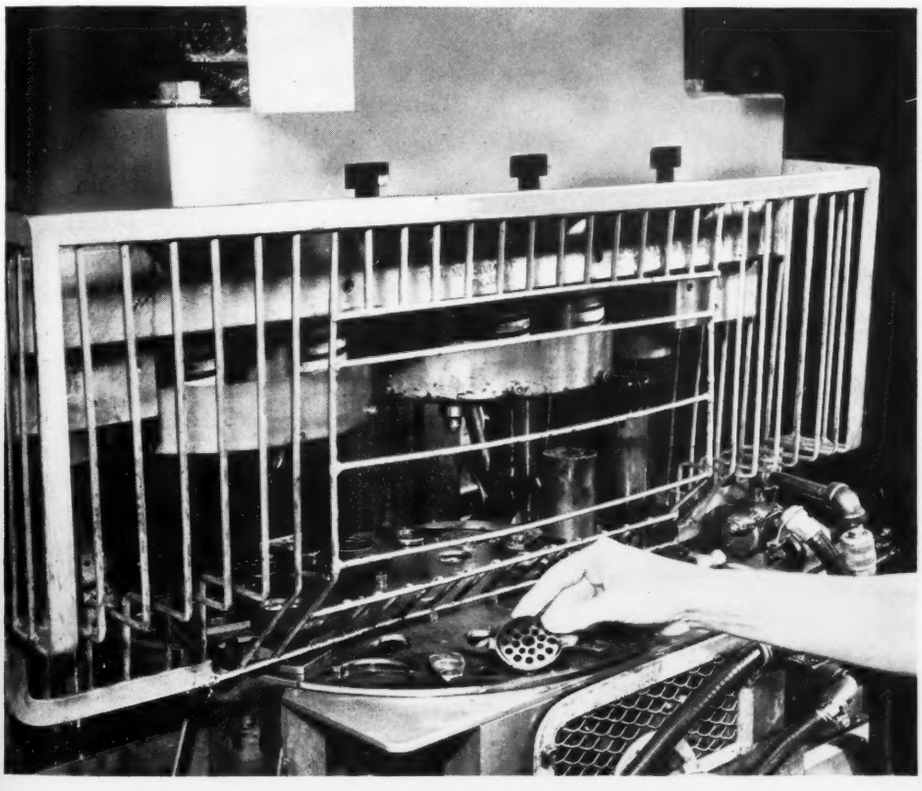


Fig. 7. Outer row of twelve holes is shaved on a 75-ton press equipped with a ten-station rotary indexing table and operating at forty-five strokes per minute. Approximately 0.019 inch of stock is shaved from each hole

twenty-one of the holes are burnished on a 56-ton press of the same type. Both presses operate at forty-five strokes per minute. The burnishing punches, which are the same diameter as those previously employed for shaving, true up the holes. No stock is removed, but metal from holes that are not precisely located is displaced outward. The burnishing punches are free to float in the lower half of the die, while the upper die member—connected to the press ram—forces the traps down over the punches.

All eight holes in the inner row and the central hole in each gas trap are burnished at the first station. Four of the nine tools mounted in the die at this station are combination burnishing punches and pilots. Every other hole in the outer row of twelve holes is burnished at the second station, and the remaining six holes are burnished at the third and last station.

Since the burnishing punches are mounted on the rotary indexing table of this press, the tools employed at the first and second stations remain

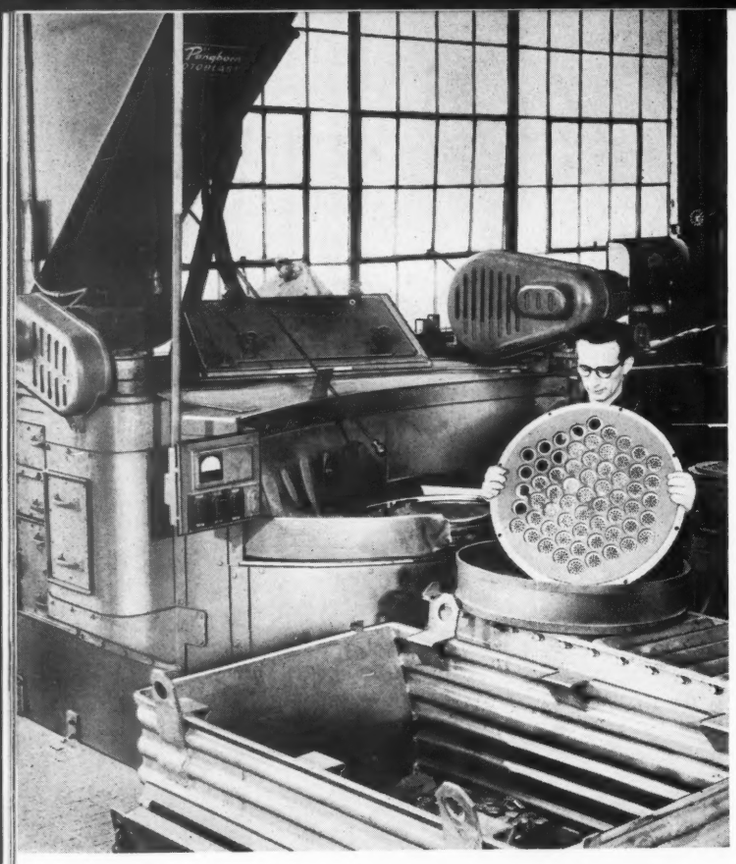


Fig. 8. Flat sides of the burnished gas traps are blasted to remove burrs and round the sharp corners, producing a part as seen at (F) in Fig. 2

in their respective holes at the second and third stations, thus preventing burnished holes from becoming distorted or misaligned when subsequent holes are burnished. The appearance of the part after this operation is seen at *E* in Fig. 2.

The flat sides of the burnished gas traps are now blasted with a mixture of steel shot and abrasive grain (Fig. 8) to peen the parts, remove the burrs, and round the sharp corners where the pierced and shaved holes break through the surface. This provides a flat, smooth surface for magnetic chucking in subsequent turning.

A Pangborn airless Rotoblast machine is used for this operation, the shot being thrown on the parts at a 45-degree angle from a rotating vaned wheel. The main rotary table of the machine is equipped with six auxiliary rotating tables. Work-holding fixtures, each holding sixty-five traps, are loaded manually on the auxiliary tables as they pass the front of the machine. The gas trap as it appears after blasting is seen at *F* in Fig. 2.

The periphery of the gas traps is turned and their corners are rounded on the Ex-Cell-O double-end, six-spindle precision turning machine shown in Fig. 9. Three parts are loaded while three are being turned. Magnetic chucks grip the traps, and a pin enters every other hole in the inner row to rotate the part. Each toolholder carries two carbide bits, and is fed at the rate of 0.010 inch per revolution. The workpieces are rotated at 480 surface feet per minute, and about 0.123 inch of stock is removed from the diameter. As the turning tools are retracted, the forming tools are advanced to cut the 0.03 inch radii.

Following this machining operation, the gas traps are heated to a hardening temperature in a Holcroft atmosphere-controlled radiant-tube belt furnace. They are then quenched in oil, after which they are drawn in a Leeds & Northrup electrically heated Homo furnace.

After hardening and drawing, the traps are again shot-blasted. This time, the parts are passed through the machine twice, being turned

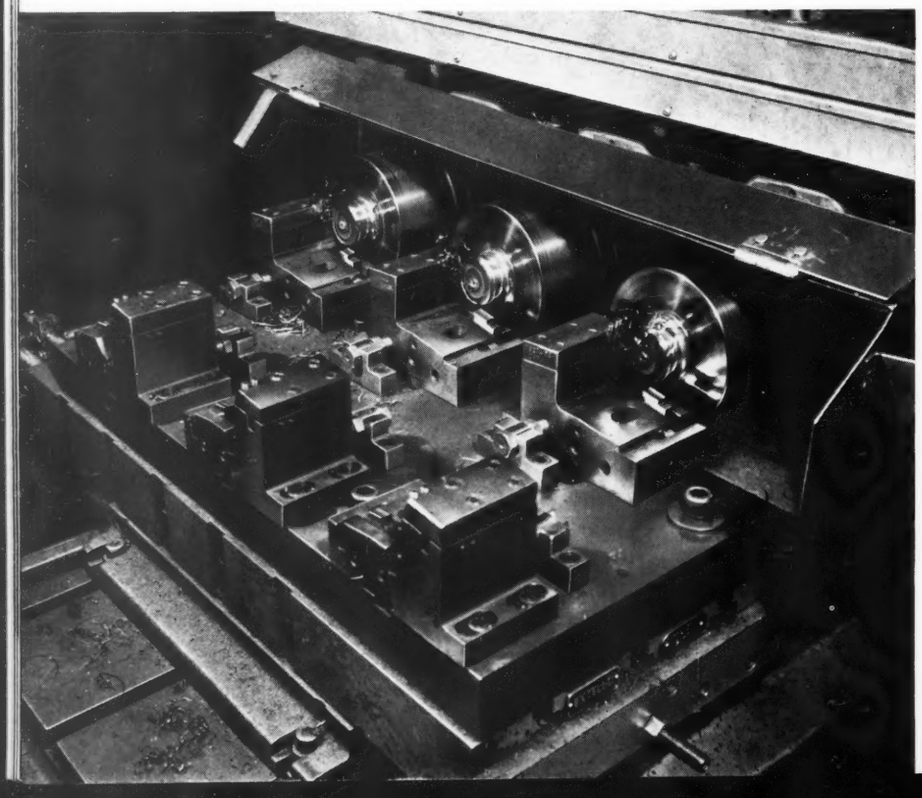


Fig. 9. A double-end, six-spindle precision turning machine is employed to turn the periphery and round the corners of the gas traps

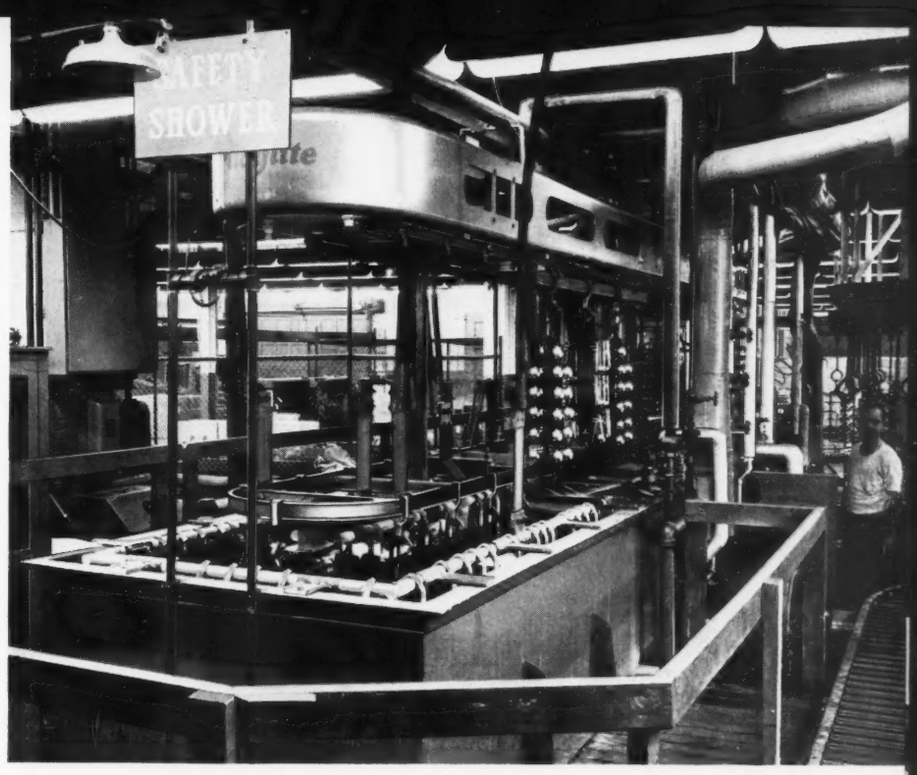


Fig. 10. All surfaces of the rocket gas traps are cadmium-plated to a minimum thickness of 0.00015 inch on a fully automatic plating machine. A plated trap is seen at (G) in Fig. 2

over between passes. In this way, burrs are removed and sharp corners are rounded on the tapered side of the traps, and any scale formed in heat-treating is removed from both sides.

Cadmium plating of the gas traps and other parts of the 3.5-inch rocket is accomplished in the Udylite fully automatic plating machine illustrated in Fig. 10. A minimum cadmium thickness of 0.00015 inch is required on all surfaces. Each of the Plastisol-coated, work-holding racks accommodates 56 gas traps, and the parts on 120 racks are cadmium-plated per hour.

The automatic cycle of this machine consists of first dipping the parts in an electrolytic cleaning tank for 1 1/2 minutes. Steel cathode bars are provided in the tank, and the work rack becomes the anode. The alkali cleaner is maintained at a temperature of 165 degrees F.

Electro-cleaning is followed by a hot water dip and a cold water overhead spray, and then a cold water dip with overhead sprays. This double rinsing prevents alkali from being carried into the acid dip that follows. After water rinsing, the work progresses through an 8- to 9-ounce per gallon sulphuric acid dip, followed by a cold water rinse with overhead sprays.

The cadmium plating tank has seventy-one anode baskets containing cadmium balls, which maintains a solution having 2.75 to 3 ounces per gallon of cadmium. Current density is held at 20 to 30 amperes per square foot. After an immersion of six minutes and fifty seconds in this bath, the parts are rinsed and sprayed in cold and then hot water, blown off, and dried.

An unusual flush-pin gage, Fig. 11, is used to check simultaneously the outside diameter of the trap, the diameter of the twenty-one holes, and the concentricity of the holes. At assembly, two spacer plates are fitted to each gas trap, their lower ends projecting through four of the holes in the inner row. These projecting ends are clinched together, and when the motor closure is placed over the sub-assembly, there are equal compartments for loading the propellant.

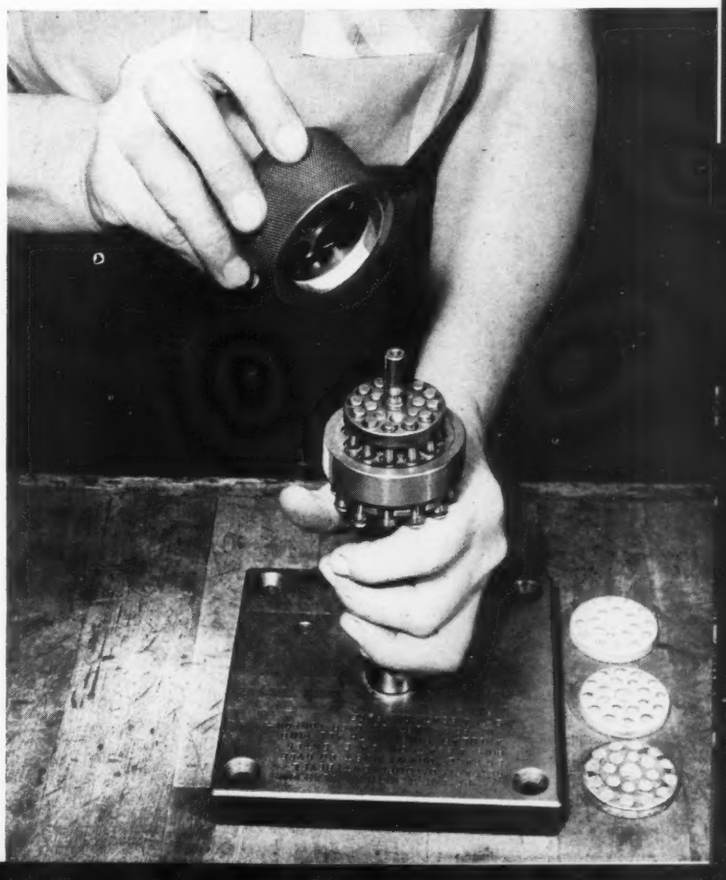
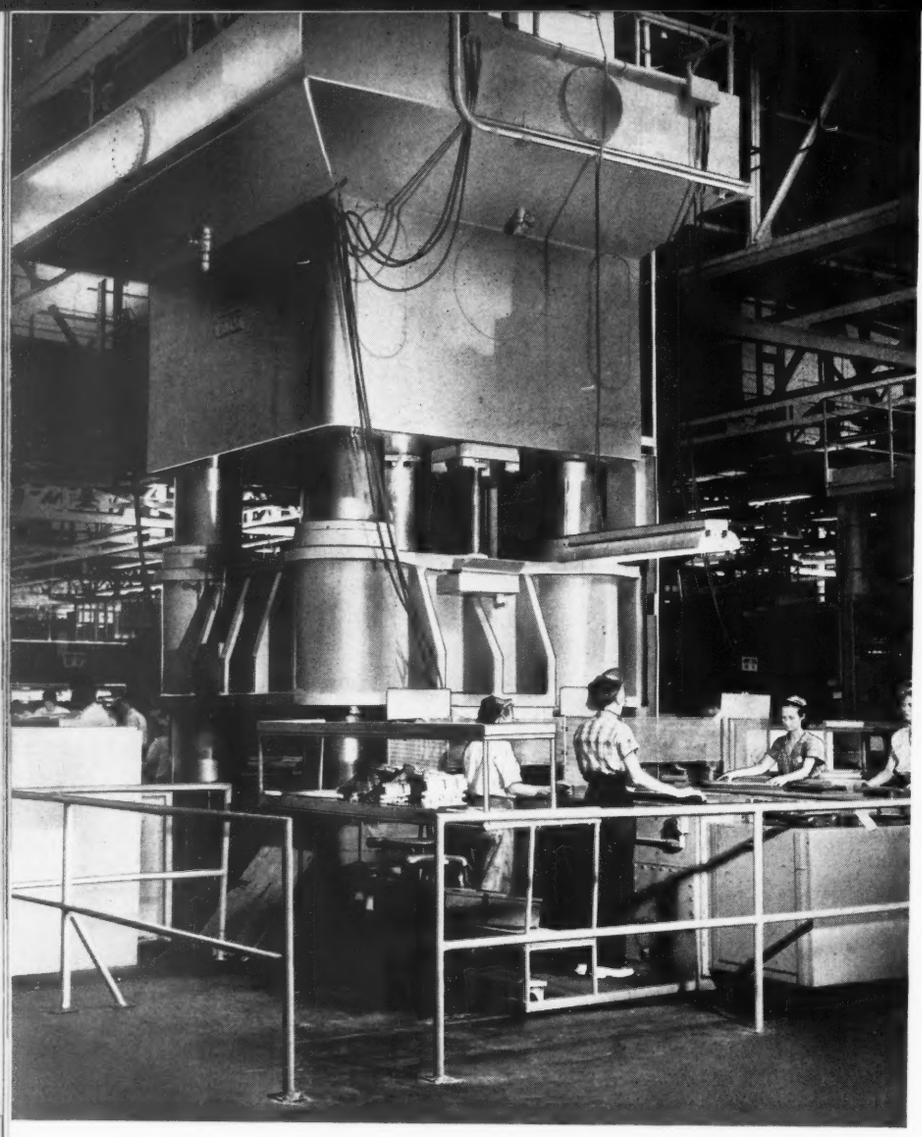


Fig. 11. Outside diameter of the gas trap, diameter of the twenty-one holes, and concentricity of the holes are checked simultaneously on this flush-pin gage

Forming with Low-



A 3000-ton Clearing press, with special moving tables and platforms, employed for forming sheet-metal aircraft parts

Flat Sheet-Metal Parts with Flanges, Lightening Holes, and Other Irregularities are Formed in Hydraulic Presses Using a Rubber Pad and Form Blocks. Recent Advances in This Method of Forming have Considerably Reduced Secondary Manual Operations. Some of These Tooling Improvements and an Ingenious Press Arrangement Employed in This Process are Described Here

By
J. A. WHITTINGHAM
General Foreman, Machine Forming
North American Aviation, Inc.
Columbus, Ohio

RECENT advances made by the aircraft industry in methods of forming sheet-metal parts in hydraulic presses have resulted in increased efficiency, extended limits of contours and materials that can be formed, and the utilization of low-cost tooling.

At the Columbus, Ohio, plant of North American Aviation, Inc., these improved methods are being applied in the production of wing ribs, stiffening channels, cowl formers, nose skins, and other aluminum aircraft parts. Hydraulic presses in which several tools can be placed to form various sheet-metal parts simultaneously are used for this work, which consists mainly of flat parts having flanges, lightening holes, recesses, beads, etc. Typical examples may be seen in Fig. 1, where special tables, which will be described later, are shown being loaded to feed a huge Clearing press.

In this operation, based on the Guerin process, the form blocks are placed on the lower platen of the press, and sheet-metal blanks of appropriate shape are held in place on the blocks by means of locating pins. The press ram is low-

Sheet Metal Cost Tools

ered by controlled hydraulic pressure, and a rubber pad in the upper platen envelops the blocks, forcing the sheet-metal blanks around them to form the parts.

One of the recent changes in this process that has greatly reduced hand-finishing operations is the use of a "draw clip," which keeps wrinkles from forming and permits much wider flanges to be formed than can usually be made without expensive punch press dies. The draw clip is generally made of aluminum, and is shaped to match the contour of the part to be drawn. It consists of three flat sheets riveted together, two outside members and an inner spacer which is made one gage size thicker than the material to be drawn. This spacer is cut to the shape of the part as it is before forming.

These tools are inexpensive to make, requiring about three man-hours for the average clip. Usually 75S-T6 aluminum alloy is used, since many other metals gall or become distorted or completely deformed. A contour saw can be employed for cutting the three sections of the clip to the shape of a part. If the included segment angle (*a*, Fig. 5) is greater than 70 degrees, or if the bevel angle is closed, the upper sheet of the clip is cut back farther than the other sheets an amount equal to the thickness of the part, and the lower edge is rounded off. The sheets are machined to the required thickness and radius on a vertical shaper. Clearance tolerances between the clip and the die are not as critical as those applied to punch press form dies.

The outside sheets are clipped to the edge of the part before forming, as shown in Fig. 2. The

Fig. 2. Parts to be formed in hydraulic presses have draw clips attached to them to restrict the flow of metal during the forming operation

Fig. 1. Sheet-metal aircraft parts are formed in a hydraulic press provided with special tables to speed loading and unloading

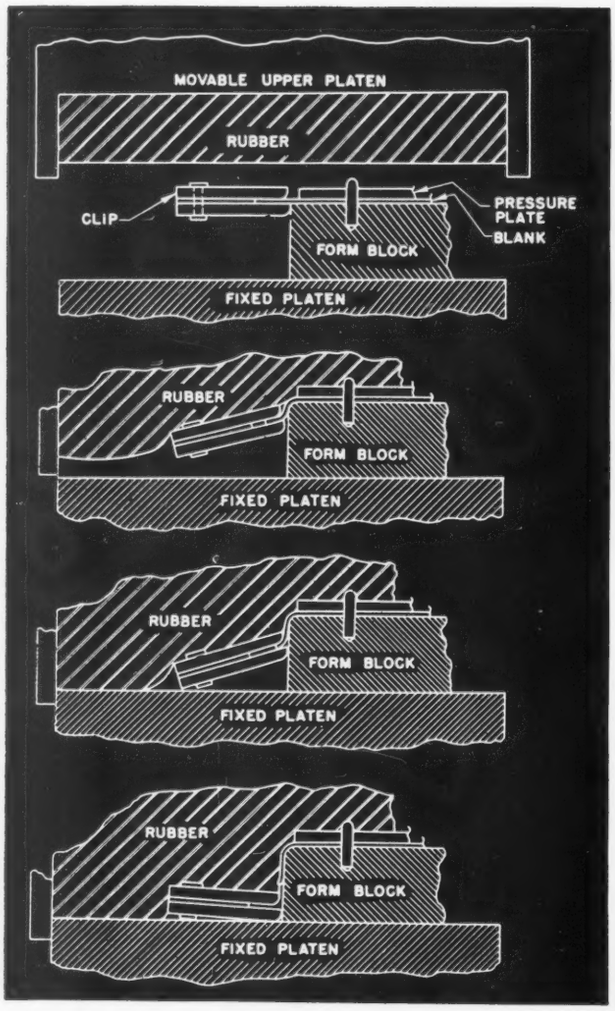


Fig. 3. Diagram showing the action of the draw clip in rubber-forming sheet-metal parts in a hydraulic press

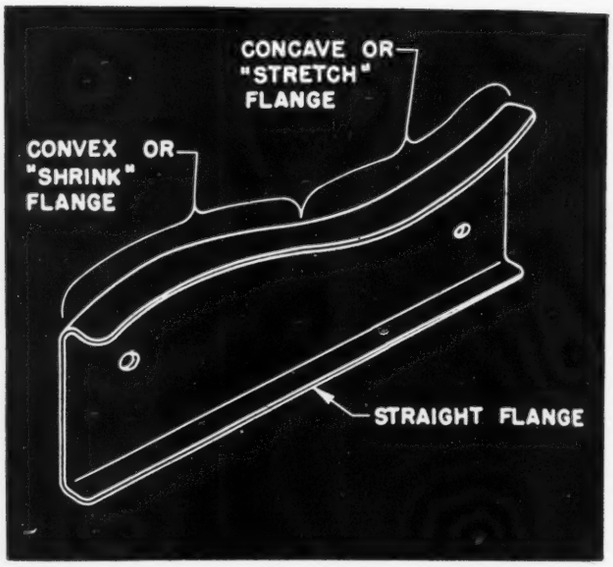


Fig. 4. Classification of types of flanges encountered in sheet-metal aircraft parts

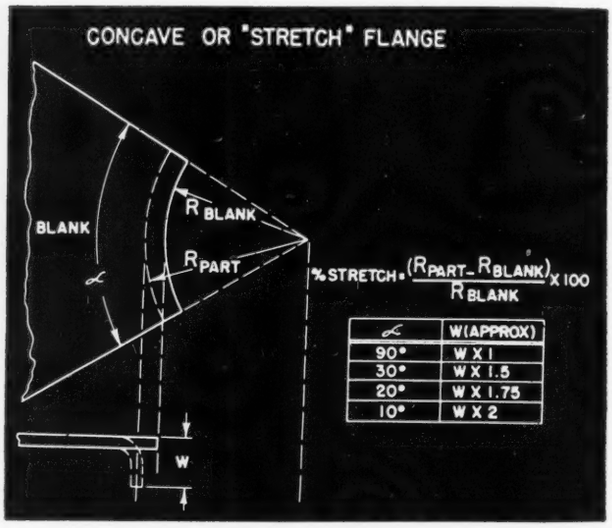


Fig. 5. Formula for calculating the percentage of stretch permissible in forming concave flanges

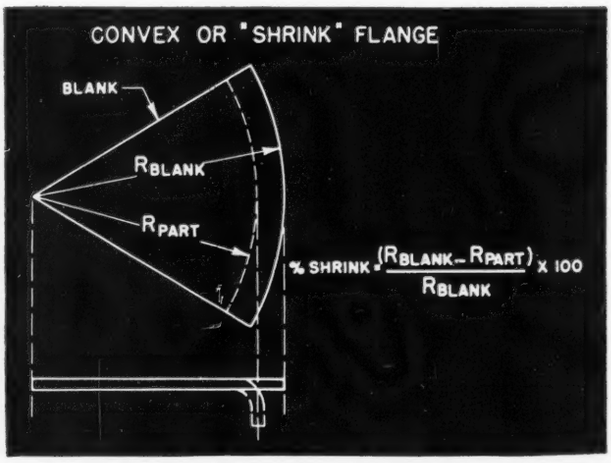


Fig. 6. Formula for calculating the percentage of shrink permissible in forming convex flanges

clip does not necessarily have to encircle the part to produce satisfactory results, but can be placed at any point where excessive wrinkling would occur in forming. The action of the draw clip in a forming operation is illustrated diagrammatically in Fig. 3. It can be seen that the clip is completely disengaged from the part at the end of the operation.

In the case illustrated, the slight curl in the edge of the part shown in the last stage results from this disengagement but does not present enough surface area to be flattened out by the pressure of the rubber pad after the clip has dropped to the table. Such curls are quickly removed by means of special pneumatic hammers, as will be described later.

The principle of operation of the clip is the same as that of the punch press die in that it restricts the flow of metal, thereby stretching excess metal instead of shrinking it and forming wrinkles. Draw clips work equally well, how-

Fig. 7. Position of draw clips on work loaded on a table prior to forming in a hydraulic press

ever, on stretch (concave) or shrink (convex) flanges, Fig. 4.

In forming stretch flanges with clips, the percentage of stretch, Fig. 5, may be as much as 25 per cent for 24S-O and 75S-O aluminum. On a concave flange, the clip restricts stretching along the extreme edge until it is pressed far enough to disengage from the part; this helps to prevent local fractures.

The 25 per cent stretch mentioned refers to an edge produced by routing. With other kinds of edges, such as sheared or blanked types that are not as smooth, the permissible elongation is much less than that amount. Another factor that influences the elongation is the included segment angle a. Fig. 5 shows the ratio between this angle and the percentage of stretch for routed edges, and gives the formula for calculating the percentage of stress.

Convex or shrink flanges, Fig. 6, are more difficult to form in hydraulic presses than concave flanges because of their tendency to buckle. Both continuous and interrupted convex flanges can be formed without draw clips, but subsequent hand-working is invariably required unless large contour radii are permissible. A rubber pad will compress aluminum alloys up to approximately 6 per cent, depending upon the thickness of the material being formed. Above this value, it is preferable to omit relief cut-outs and form by the clip method.

For calculating the allowable percentage of shrinkage in convex flanges formed with draw clips, the formula given in Fig. 6 may be used. The maximum for annealed aluminum alloys is 25 per cent. Flange reliefs are often omitted when clips are used. This is a distinct advantage, as ribs or frame members for parts subject to vibration can be formed with continuous flanges to reduce stress concentrations.

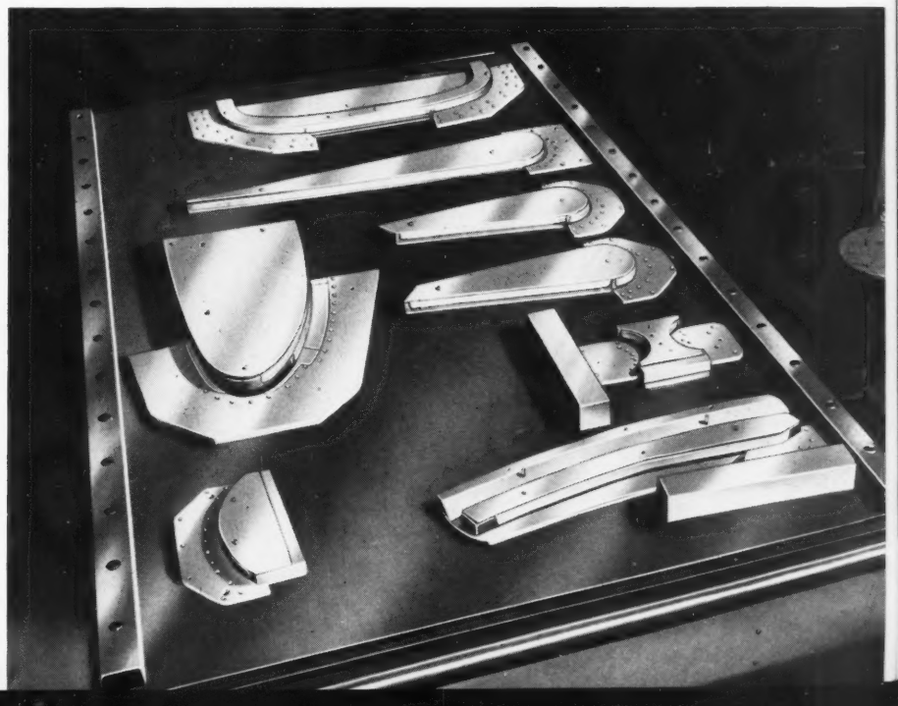


Fig. 8. After forming these sheet-metal parts, the draw clips drop from the work to the table

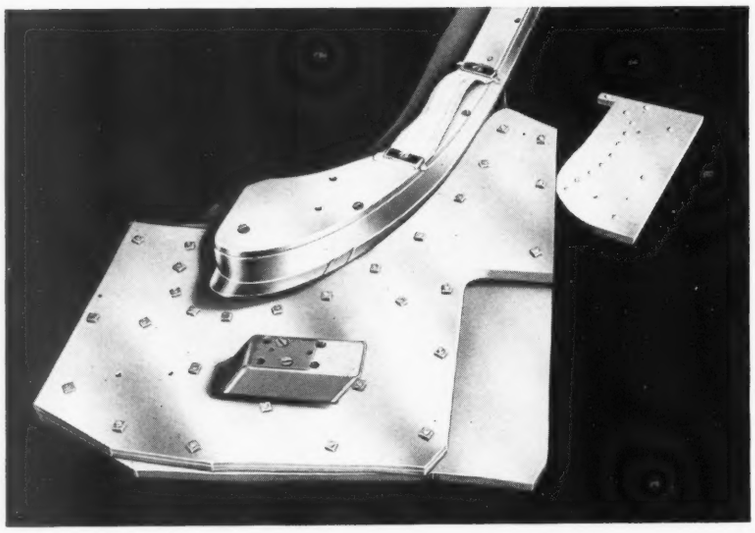


Fig. 9. Draw clips are guided and held close to the form block when forming bevel flanges

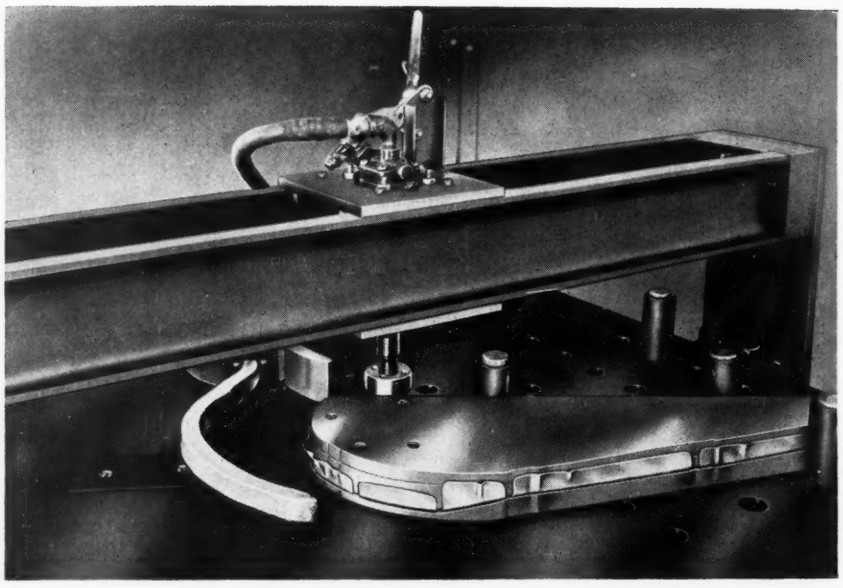


Fig. 10. In performing hand-finishing operations, a "lead slapper" is employed to force the flange against the die. This device considerably reduces the time required for this work

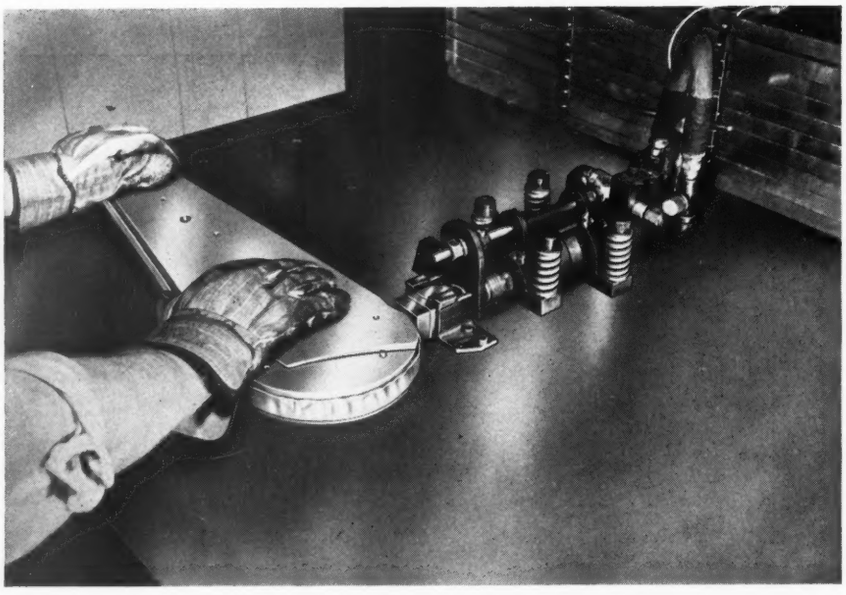


Fig. 11. Pneumatic hammers are used to remove the slight curl left in a part formed with a draw clip

Fig. 12. Two operators at each of four tables on this 3000-ton press load and unload form blocks

Several dies with clips attached are shown on a press table, ready for the forming operation, in Fig. 7. The same tools after forming are seen in Fig. 8. It will be noted that the draw clips encompass only those areas that encounter severe shrink and stretch, the remainder of the part being formed by rubber in the conventional manner. Where the clip is not self-aligning, the die is so placed that the clip is backed up against the side rail of the table or a square bar is used to hold it in position while forming.

Both open and closed bevel flanges can be formed with draw clips. As may be seen in Fig. 9, the clip is guided and held close to the form die by one or more blocks. In this way, the clip restricts stretching along the sensitive edges until it is disengaged from the part, thus producing an even stretch away from the edge. As previously mentioned, this tends to eliminate fractures of the material at local points.

When hand-finishing operations are necessary after forming and heat-treatment, specially developed tools are employed. One of these, known as a "lead-slapper," is shown in Fig. 10. In using this tool, the part in the form block, with the pressure plate in position, is held in place on a table by means of pneumatic pressure. A lead bar, similar to a large bar of solder, is then slapped against the flange in a series of reciprocating motions. Being soft, the lead wraps around the part, conforming to its shape, and forces the flange against the die by impact. Formerly, this operation consumed a good deal of time.

The curl that remains in the edge of any part formed by a draw clip is quickly and easily removed by means of pneumatic hammers, Fig. 11. This is an adaptation of the ordinary rivet gun, with a pad of laminated plastic attached to the flat rivet set. The part, with its die and pressure plate, is held on a table against the gun and quickly rotated or traversed so that the plastic pad progressively flattens out the curl.

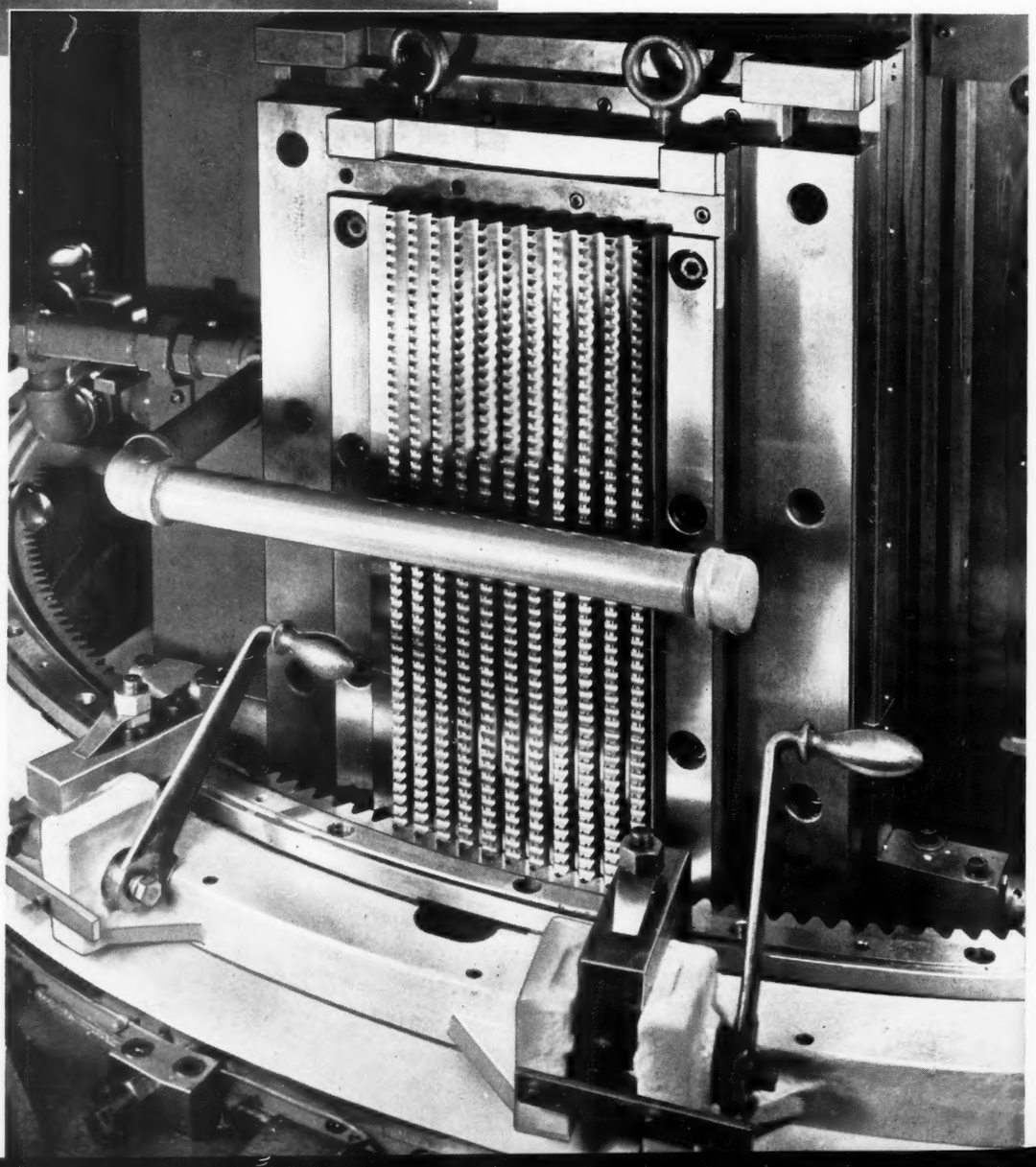
The special tables developed for the 3000-ton Clearing press shown in the heading illustration provide another means of materially increasing production in this plant. An assembly consisting of two loading tables and two stock racks mounted on a platform is located on two sides of the press. The platforms move on tracks parallel with the sides of the press to align one of the loading tables on each side with the press bed. Of the two tables thus aligned, one, moving at right angles to the travel of the platform, carries a load of eight to twelve parts, mounted in their dies, under the ram of the press.

After the press stroke, this table moves out for unloading, while the corresponding table at the opposite side feeds another load of work into the press. The platform on which the first table is mounted then moves to align the second table on that particular assembly with the press bed. The same procedure is repeated on the opposite side following the second press stroke. During these back and forth movements of the tables, eight operators, two at each table, load and unload the form blocks, as seen in Fig. 12.

Broaching with Work

Fig. 1. A completed tank turret ring, 6 feet in diameter, in which 294 internal teeth are broached by means of the unusual set-up seen in Figs. 3 and 4

Fig. 2. Close-up view of the eleven-tooth, twelve-segment broach, 9 inches wide by 60 inches long, used to cut internal teeth in tank turret rings



6-Foot Tank Turret Rings Encircling the Machine

Time Required for Cutting 294 Internal Gear Teeth in 6-Foot Diameter Tank Turret Rings has been Reduced from 4½ Hours to 30 Minutes by Mounting Rings on a Huge Indexing Fixture that Encircles a 30-Ton Vertical Broaching Machine

By COLONEL R. E. HANES
Chief of Manufacturing
Detroit Arsenal of Army Ordnance
Center Line, Mich.

A BROACHING machine that does in 30 minutes what took 4 1/2 hours by former methods, resulting in a saving of $400 per day in the production of turret ring gears for tanks, is now in operation at the Detroit Arsenal of Army Ordnance. This machine, manufactured and tooled by the Colonial Broach Co., Detroit, Mich., cuts 294 internal teeth in the 6-foot diameter ring gear shown in Fig. 1 in thirty minutes. Three-fourths of the capital outlay and seven-eighths of the number of machine tools required with the method previously used have been eliminated by this installation.

For broaching the teeth in this large ring, Colonial engineers designed a huge indexing fixture that encircles the 30-ton, 66-inch stroke vertical broaching machine seen in Fig. 3. The operation is accomplished by a combination of indexing and shuttle movements of the fixture. First the fixture slides on rollers into the cutting position under the broach. This tool, as seen in Fig. 2, is an eleven-tooth, twelve-segment surface broach, 9 inches wide by 60 inches long. After the broach has passed down through the work, the fixture moves out of the cutting position and the broach is returned to the top of its stroke. Shuttle movement is accomplished through a hydraulically controlled locking cam action.

Indexing of the turret ring to the next cutting position is also effected by hydraulic cylinders. These rotate the part held in the fixture into the proper position for the next cut, a hydraulically controlled index-pin locking the fixture in place. The turret ring is secured in the fixture by hand-clamps, and is ejected hydraulically. The selection of the eleven-tooth broach was dictated by the capacity of the machine available at the time. Fig. 4 shows the broach making the last pass to complete the forming of the 294 teeth.

The teeth formed by the broaching operation are checked while the ring is still in the machine. The gage that checks the part both for tooth spacing and size is integral with the indexing fixture, and passes through the column of the machine. The teeth in the 4-pitch ring gear have a 25-degree pressure angle and are 0.525 inch deep, with a face width of 1.385 inches. The pitch diameter of the gear is 73.5 inches. Spacing of the teeth is held within a tolerance of 0.001 inch. A tank turret ring is shown in Fig. 5 as it comes to the broaching machine, while a completed ring gear is seen in Fig. 1.

To produce the part to such close tolerances, high precision was required in machining the fixture. Eccentricity on the assembled fixture is less than 0.0005 inch per foot of diameter. Also, special grinding machines and checking equipment were developed by the Colonial Broach Co. to produce the broach to the required limits of accuracy.

The broaching machine used is a single-ram, vertical broaching machine taken from World War II surplus at the Detroit Arsenal and rebuilt to accommodate the 4-ton indexing fixture. Hydraulic power equipment that was within the column of the standard machine is now mounted

Fig. 3. This 30-ton, 66-inch stroke vertical broaching machine is used in cutting the teeth in a tank turret ring more than 6 feet in diameter

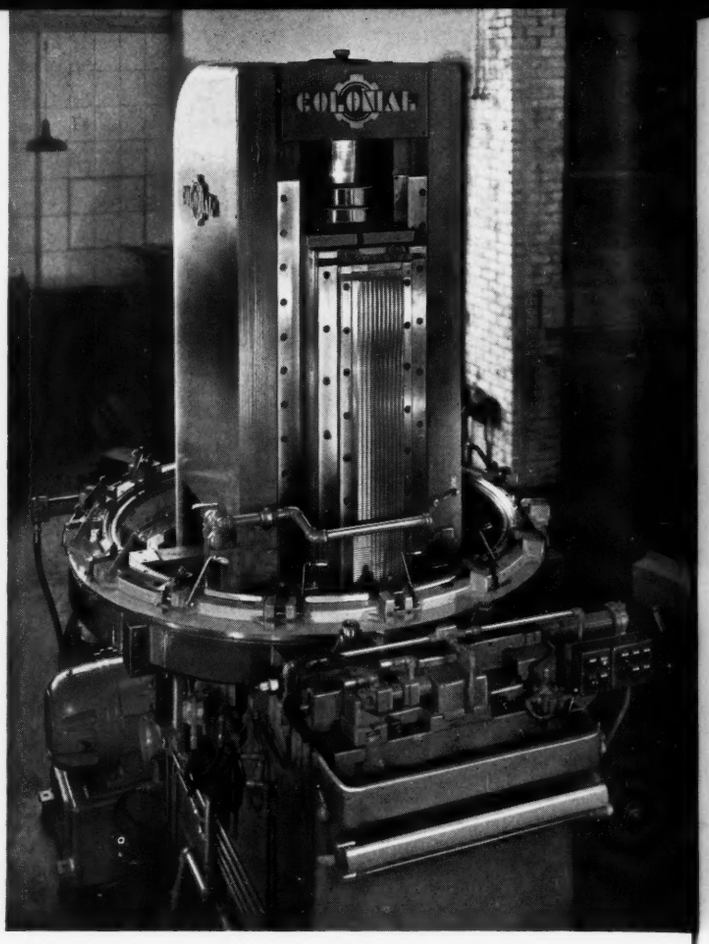
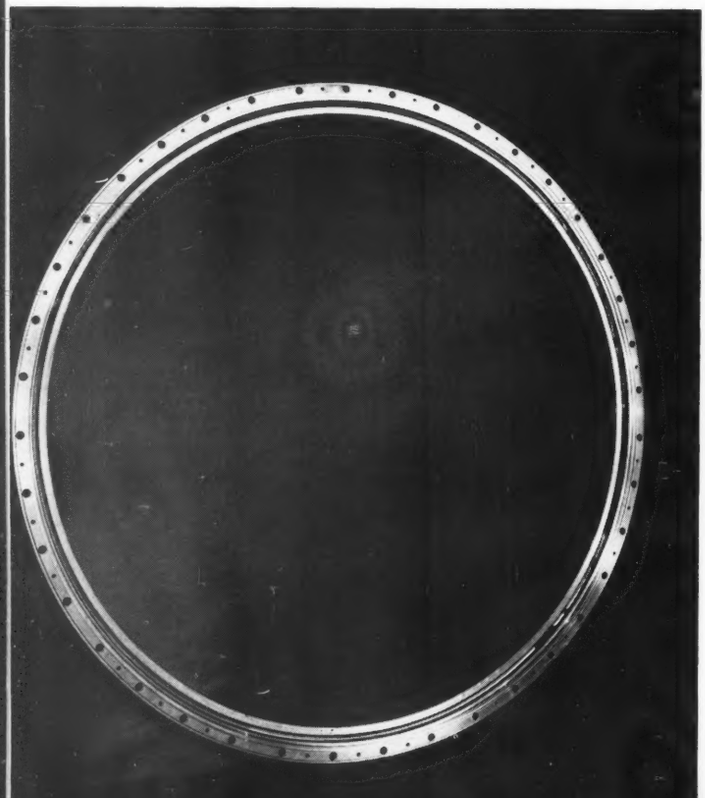


Fig. 4. Close-up view of huge indexing fixture that encircles the broaching machine, showing broach making last pass to complete the teeth

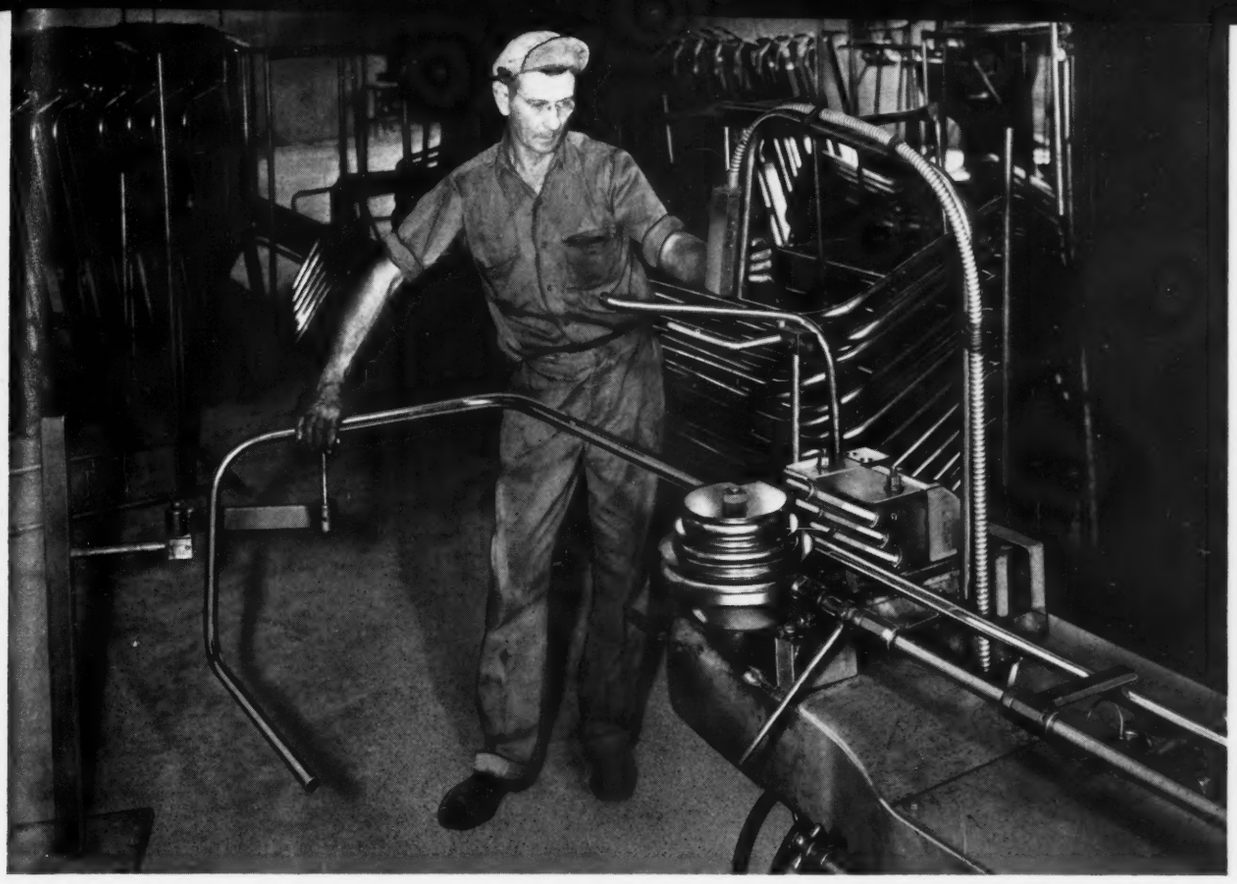
Fig. 5. Tank turret ring as it comes to the broaching machine for cutting the 294 internal teeth



on a base at the rear to facilitate fixture mounting and provide additional hydraulic and electrical control functions.

The machine operates on a semi-automatic cycle, in which the indexing is controlled independently of the machine operation. For indexing, the cycle start button is pressed. This actuates an electrically controlled hydraulic circuit that causes the indexing mechanism to be automatically reset, the fixture to be indexed, and the indexing plunger to be seated for locking the fixture in place.

To start the operation, handles are pulled which actuate the hydraulically controlled circuit. This moves the fixture into the broaching position, and the ram descends. At the bottom of its stroke, the ram contacts a control finger that stops its downward movement. Following the operation, the table automatically backs out of the cutting position, and, in so doing, actuates an interlocking switch that reverses the travel of the ram. The broach then returns to the top of its stroke, ready for the next cycle.



Bending Tubes to Different Radii with a Triple Die

Truck-Seat Frames are Rapidly Formed from Tubing at the Rate of 340 Bends per Hour by Means of a Unique Set-Up Employing a Triple-Radius Die on an Automatic Production Bending Machine

OUTPUT of tubular truck-seat frames has been substantially increased and handling costs reduced at the Randall Co., Wilmington, Ohio, by equipping a Pines automatic production bending machine with a triple-radius die, as seen in the heading illustration. With this set-up, believed to be the first triple-radius die ever employed in bending, the workpieces can be completed on one machine with no tool changes. Normally, each bend having a different radius would require a change in the tooling set-up on the machine; or to obtain maximum production of such parts, several machines might be employed, with each machine tooled to bend the work to a different radius. The latter method, however, would require considerable handling of the work.

The truck-seat frames are formed from cold-rolled steel tubes, 1 1/8 inches in diameter by 182 inches long, with a wall thickness of 0.065

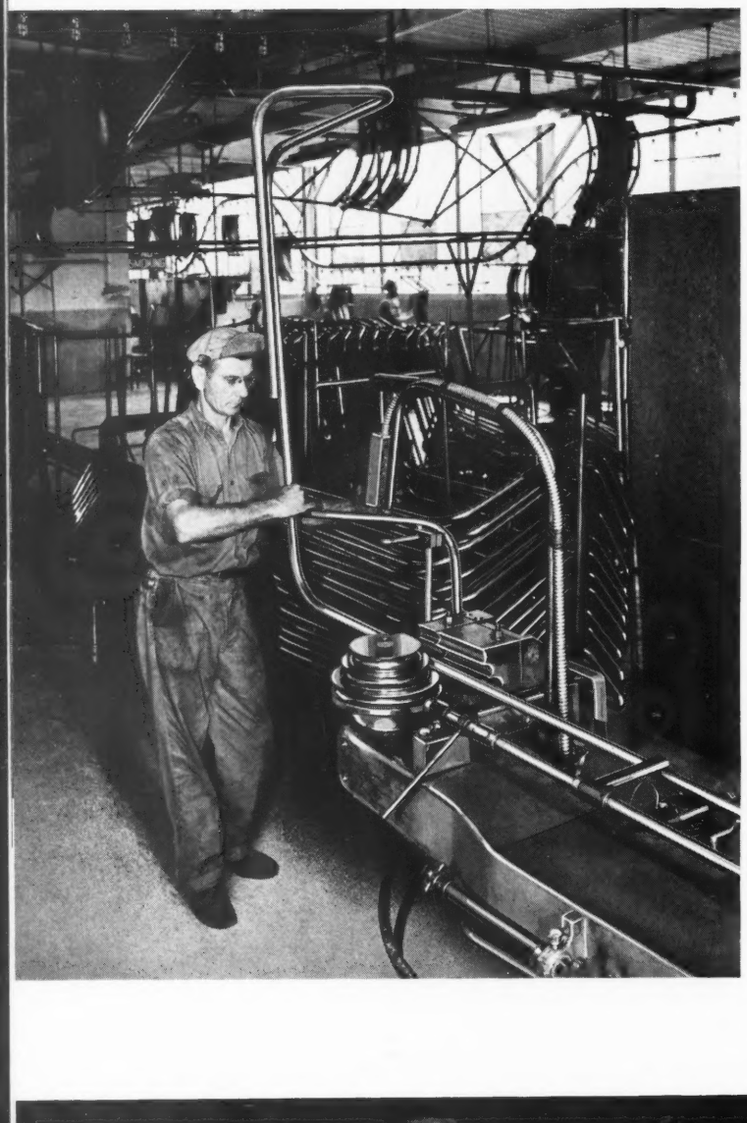


Fig. 1. Fifth bend in forming a truck-seat frame is made with the tube held in the center position in the triple-radius die on a Pines bending machine

inch. Each frame requires six bends of three different radii. All of the bends form approximate right angles, but lie in different planes.

To form the first bend, which has a radius of 3 1/2 inches, the tube is placed in the top position in the three-position die. The second bend, having a radius of 4 7/16 inches, is made with the tube in the center position. After this operation, the tube is lowered to the bottom position in the die, as seen in the heading illustration, where two different bends—each having a radius of 5 7/16 inches—are formed.

Next, the tube is raised to the center position again, as seen in Fig. 1, and another bend having a radius of 4 7/16 inches is formed. Finally, the sixth bend, which has a 3 1/2-inch radius, is made with the tube in the top position in the die, as seen in Fig. 2.

In the automatic cycle of this push-button controlled, hydraulically operated machine, the bending arm moves forward and returns automatically at the end of each bend. The circular forming die *A*, Figs. 3 and 4, around which tube *B* is bent, is of one-piece construction, while the clamping and pressure dies *C* and *D*, respectively, are segmented assemblies, with each of their three clamping grooves independently adjustable.

Fig. 2. With the tube raised to the top position in the triple die, the sixth and final bend — which has a radius of 3 1/2 inches — is made

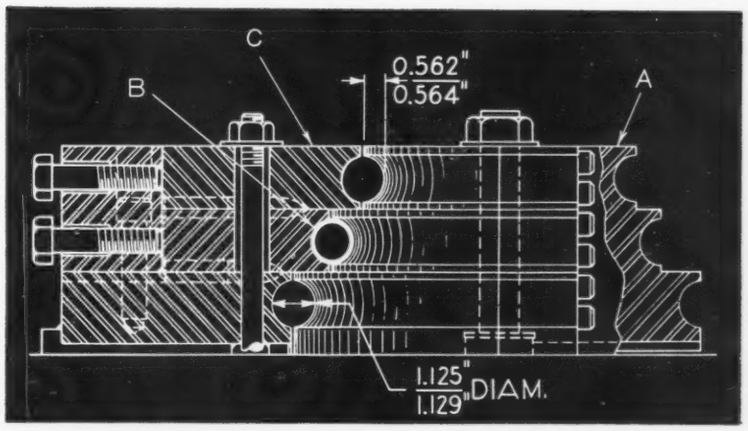


Fig. 3. Sectional drawing of the one-piece circular forming die (A) and the segmental clamping die (C). Work (B) is shown in center position

Draw-bending is employed in these tube-forming operations, the clamping die being rotated with the bending arm and forming die. Both the clamping and pressure dies guide the tube around the forming die, but the pressure die is stationary—being fixed to the frame of the machine—and restrains the free end of the tube from moving out of its original straight-line position. The speed of rotation of the bending arm and clamping and forming dies is 23.5 R.P.M.

The distance between bends along the axis of the tube is gaged manually from swing type stops seen along the top of the machine at the right in the heading illustration, while the plane of the bends is determined by simple floor-mounted gages seen at the left.

Since the time normally lost in changing over the tooling set-up is eliminated, production is maintained at a rate of 340 bends per hour. Accuracy of the bends is maintained within 1 degree of the desired angles. After the last bend, the loose ends of the tube meet in a close butt fit, which simplifies welding. When the two ends of each tube have been welded together, the completed truck-seat frame is japanned or lacquer-finished prior to shipment.

A wide variety of bends—such as serpentine, coil, compound, and multiple bends—can also be made on this machine. Different methods—roll-, compression-, stretch-, as well as draw-bending—can also be employed to suit material specifications and product requirements. Piping, tubing, and extruded or rolled sections and moldings can be accurately formed at similarly high production rates. A change-over in set-up can generally be made in about thirty minutes.

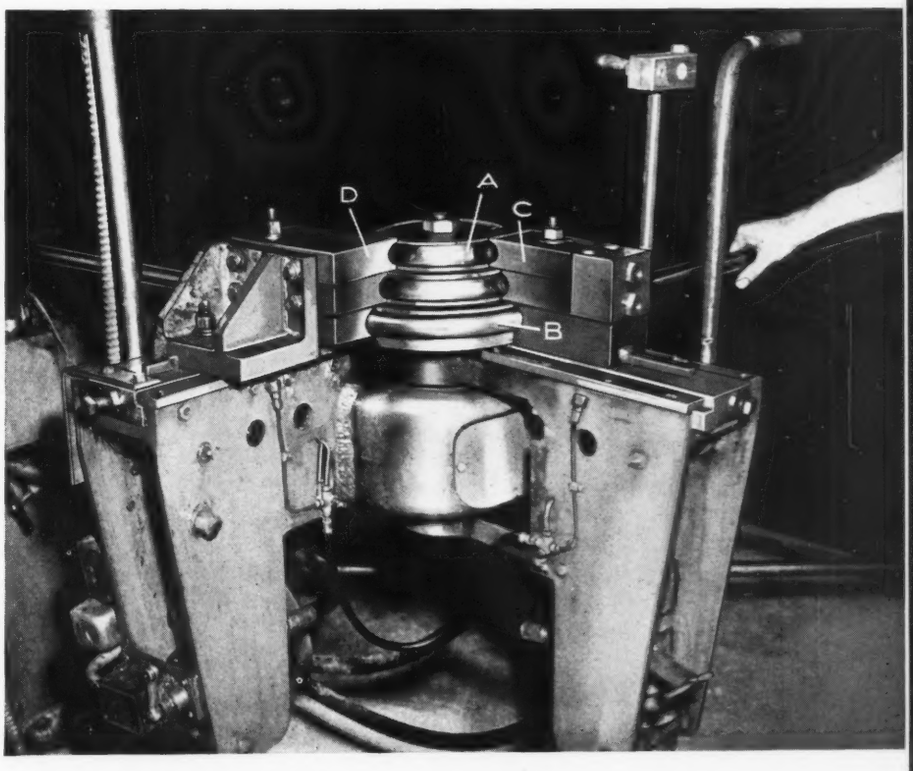


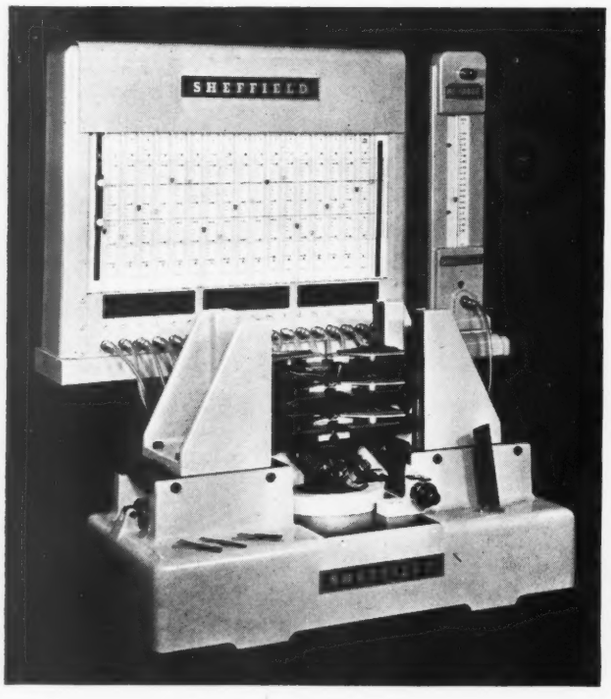
Fig. 4. Close-up view showing position of clamping die (C) at completion of bend. Bending arm moves forward and returns automatically after each bend

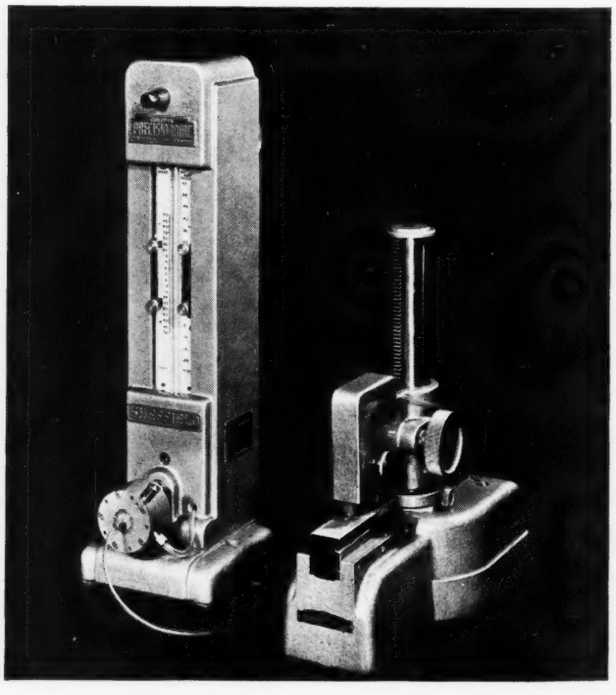
Latest Production Equipment

This Section Includes Only Machines and Tools of New or

Sheffield Precisionaire Gaging Machine and Gaging Equipment

New and unusual precision measuring instruments, gages, threading tools, and "Crushtrue" grinding equipment will be featured in the exhibit of the Sheffield Corporation, Dayton 1, Ohio. Shown for the first time will be the multi-dimension Precisionaire instrument illustrated in the lower view to the left. This new instrument has an "Airechart" for checking the contour, thickness, tilt, and angle of jet-turbine blades at eighteen to twenty-six or more points simultaneously. Each gage takes the place of eleven conventional type gages. The Precisionaire cylinder-block gaging machine shown in the upper view to the left will also be exhibited. This instrument gages four cylinder bores at four places each in a V-eight engine block, checking a total of sixteen diameters simultaneously. The conditions of the bores are quickly determined on the float graph or "Airechart" by observing the positions of the floats in the Precisionaire tubes. The proper classification of each bore is then stamped on the gage by the operator through a device incorporated in the machine. A turntable rotates the cylinder block so that the remaining





to be Seen at the Show

Improved Design that Have not Previously been Described

four bores can be inspected in turn. Out-of-round conditions can be gaged as the spindles are rotated mechanically. Visual inspection of each cylinder wall is facilitated by two lighting units, one being located at each end of the gage. Handling of the cylinder block is kept to a minimum, as the gage is installed in the production line.

An "Electronic Leadchek" designed to measure the lead of threads, leadscrews, racks, etc., to very close tolerances will also be exhibited for the first time. This gage will accommodate work of such length that threaded sections 36 inches long can be checked at one setting of the instrument.

Another new product is the Precisionaire gage-block comparator shown on the opposite page in the lower view to the right, with dual amplification of 50,000 and 100,000 to 1 for checking sets of gage-blocks. The scale for the 100,000 amplification is graduated in one-millionths of an inch, each millionth being represented by approximately 1/8 inch on the scale. This type of gage has the advantage of eliminating metallic contact with the work or block.

Several new applications of the Precisionaire for checking instrument type bearings will be displayed, in addition to the Sheffield radial clearance and race matching gages now being used in the bearing industry. Another interesting exhibit will be the "Precisionaire" gage illustrated in the lower left-hand corner of this page. This gage analyzes the condition of a connecting-rod relative to the axis of the pin and bores. In a matter of seconds, the bend, twist, and center distance can be gaged by referring to the "Airechart" formed by the positions of the floats in the four-column Precisionaire instrument.

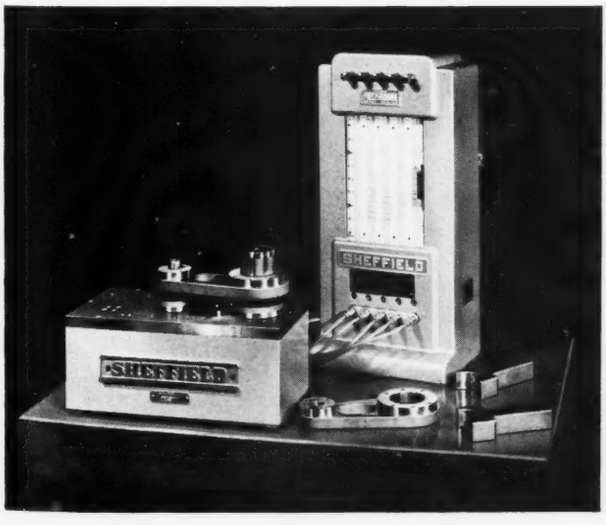
Precisionaire gages for checking the size and alignment of crankshaft and camshaft bearing bores in cylinder blocks, center distances of holes in transmission parts, squareness, straightness, and other dimensions and conditions will also be shown.

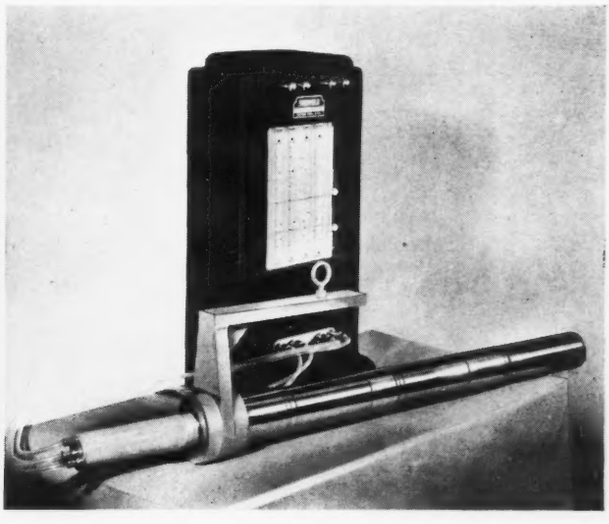
All of the main bearing bores in a cylinder block are gaged simultaneously by a spindle used in connection with a column type Precisionaire, as illustrated in the view in the lower right-hand corner of this page. The spindle of this gage normally has a chrome-plated body or tungsten-carbide inserts to resist wear. In order to facilitate loading and handling, an overhanging arm is provided that incorporates a bearing to allow the spindle to be easily rotated while checking bores for out-of-roundness. A "true position" stop may be provided so that the front and rear of each bore can be individually gaged to determine taper. In a similar manner, alignment can be checked in both the crankshaft and the camshaft bores.

Visual gages and electronic gages, as well as other Precisionaire applications for both tool-room and production work, will be included in the exhibit, which will also feature Murchey collapsible taps and die-heads, a complete array of "Crushtrue" grinding attachments, and the Sheffield "Measuray" for measuring thickness of moving stock, such as metallic and non-metallic strip. Booth 710.

Elox "Electron Drills"

Broken taps and drills will be removed and round or irregular-shaped holes will be drilled in the hardest metals on "Electron Drills" at the exhibit of the Elox Corporation, Clawson, Mich. This





equipment works on the principle of creating a series of intermittent arcs which disintegrate or vaporize the metal. Removal of 8-32 taps in less than four minutes and of 3⁄16-inch drills in six minutes without damage to either the original threads or the work-piece can be accomplished. In addition to a large Model M-10 "Electron Drill," which is a heavy-duty radial drill stand designed for "Electron Drilling," the same type equipment in smaller models for medium-sized plants will be shown. The equipment is available either with or without power feed. Self-contained models and models designed to be used with standard drill presses will be displayed. The newest unit to be shown is the M-51, which is only 14 by 16 inches over all, and yet is suitable for extracting taps and drills from normal size work-pieces. All units operate on 110-volt, 60-cycle current. Booth 318.

Viking Surface Grinder and "Speed-Mill" for Climb Milling

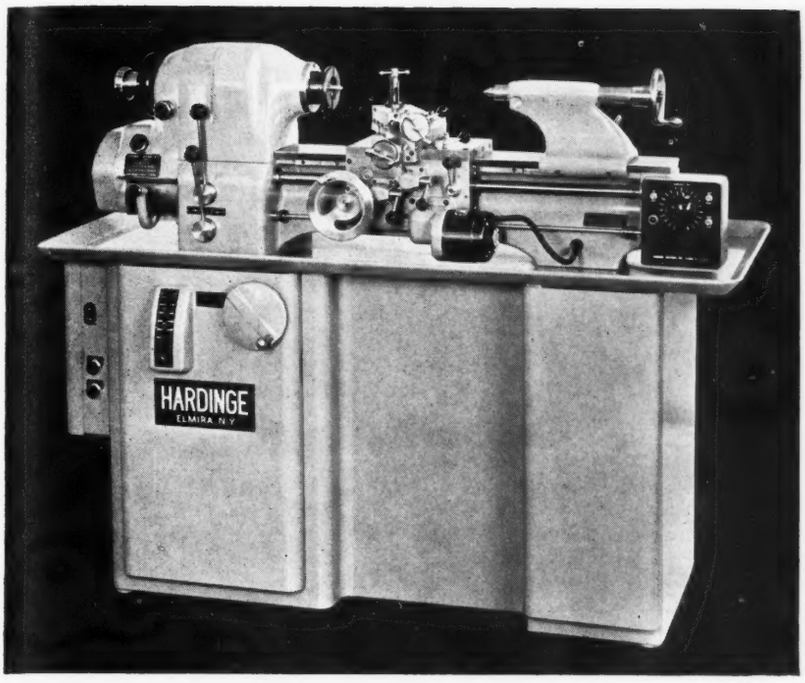
(Below) Bench type precision surface grinder to be exhibited for the first time at the A.S.T.E. Show by Viking Industries, 220 Montague St., Rockford, Ill. This machine has an extra heavy headstock, micrometer adjusting dials, and a precision spindle with heavy-duty ball bearings. Standard equipment includes a new compact magnetic chuck, a 1/3-H.P. continuous-duty, dual-voltage motor, and a spindle designed to use a wheel 4 inches in diameter. A No. 7 Brown & Sharpe taper permits setting up the machine with slitting saws, screw slotting cutters, etc. An adjustable pilot light is mounted on the 11- by 18-inch base of the machine. The table has a working surface of 9 1/2 by 6 inches. A convenient unit with switch for demagnetizing can also be provided. The table is quickly and easily traversed by a hand-lever. (Right) Improved, hydraulic "Speed-Mill," which will also be exhibited for the first time at the exposition. This machine is designed for fast machining of small parts requiring close limits and fine finish. It has infinitely variable spindle speeds and automatic table travel, which substantially increase the output capacity. The table cycle incorporates variable cutting feeds, rapid approach, and quick return. Two separate models are now provided, one designed with a new duplex system that handles climb-milling jobs, and one for conventional milling work. Both are cabinet type units, 30 inches deep by 32 inches wide, with a height of approximately 52 inches. The table is driven by a 1/2-H.P., three-phase, 60-cycle motor, and the spindle by a 3/4-H.P. motor of the same type. A single unit drive-shaft operates with the coolant and hydraulic pumps. Both machines have a table working surface of 7 5/8 by 24 1/2 inches. The maximum cutting length is 7 inches. The table has a traverse adjustment of 1 3/4 inches, and a vertical adjustment of 7 1/2 inches. Milling cutters up to and including 6 inches in diameter can be used. Booth 1208.

Adamas Carbide Tool Tips and Dies

A complete line of tungsten-carbide tool tips, dies, and wear-resistant parts will be exhibited by the Adamas Carbide Corporation, 1000 S. 4th St., Harrison, N. J., including standard single-point tool tips; reamer blanks; wear strips; and bushings. Forty different preformed shapes, illustrating the variety of forms that can be produced in carbide, with explanations as to their applications, will also be exhibited. Solid carbide inserts of round, triangular, square, and rectangular shapes—all furnished finish-ground, ready for use in insert type tools—will be shown. Other interesting features of the display will be an operating pellet press used for automatic quantity production of carbide blanks. Booth 1301.

Chromium-Carbide Gages to be Exhibited by G-E Carboloy Department

The Carboloy Department of General Electric Co., 11147 East 8 Mile Blvd., Detroit 32, Mich., will exhibit a wide variety of its products, including its new Series 600 chromium-carbide gages. The latest Carboloy single-point tools and tool blanks, as well as carbide press dies, with examples of the types of work they produce, will be in the exhibit. Alnico permanent magnets and Hevimet radiation-resistant metal will also be shown. Booth 539.

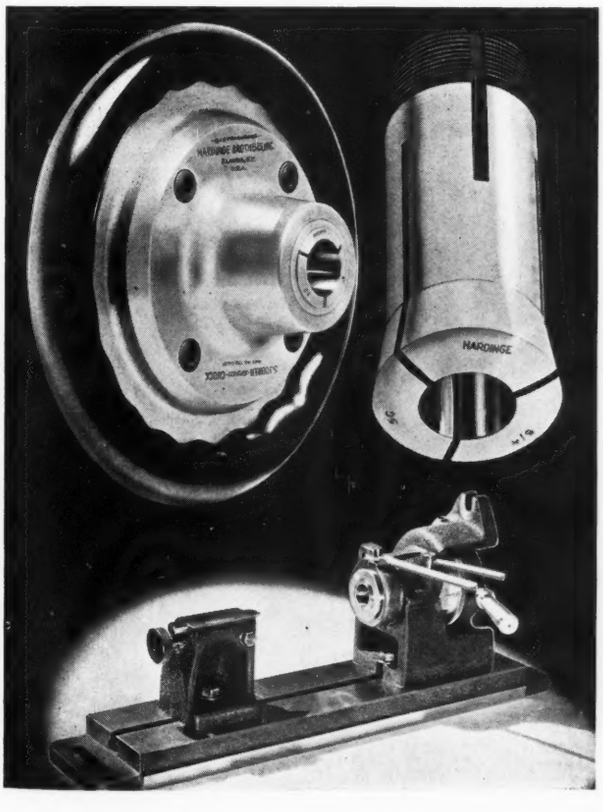


Hardinge Precision Lathe and Work-Holding Fixtures

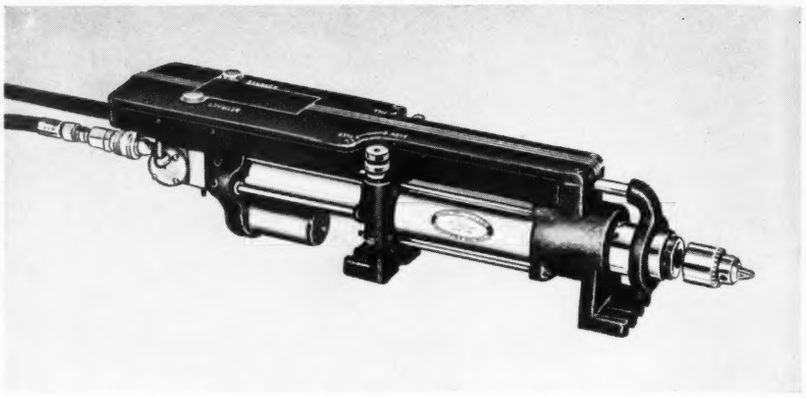
The new Model HLV lathe for tool-room and production work illustrated above will be shown in operation at the exposition by Hardinge Brothers, Inc., Elmira, N. Y. Demonstration will duplicate actual plant conditions to show the high degree of accuracy produced, high speeds obtainable, and ease with which the new lathe can be operated. This machine is designed especially to fill the gap between the plain precision bench lathe and the heavy-duty engine lathe. Features include independent variable feed for carriage and cross-slide, enabling the rate of feed to be changed instantly without stopping machine for shifting gears; independent variable speed for the headstock spindle to secure every possible combination of speeds within the range of 125 to 3000 R.P.M.; and precision gear-box and lead-screw reserved for threading only, so that the original accuracy is maintained for threading operations. New collet index fixtures designed to hold work accurately and still provide for rapid indexing, as seen below in the illustration at the left, will also be exhibited. The special Hardinge-Sjogren speed collet chuck shown at the top left in the illustration is designed for tool-room lathes, engine lathes, and grinders. The capacity of this chuck is said to have been increased up to 40 per cent by provision for holding—without draw-tubes, adapters, or sleeves—any bar that can be passed through the spindle. The Hardinge draw-in collet shown at the top right and the collet index fixture shown in the lower view will also be demonstrated. Booth 1516.

New Multiple Nut-Runners Announced by Ingersoll-Rand

The Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y., will exhibit its new multiple nut runners, designed for running two or more nuts simultaneously (see illustration below at right). It is claimed that considerable savings in time and costs are made possible by this new equipment. The actual time saved by the nut-runners is in direct proportion to the number of nuts or cap-screws to be run. Correctly spaced and mounted individual nut-runners are connected to a common manifold mounted on the machine, and the unit



is provided with one set of handles. As the multiple nut-runners are used with spring balancers, the weight of the combined tools is not objectionable. Advantages claimed are high quality control; uniform torque on each nut; two or more nuts driven at once, in the time formerly required to drive one; operator safety; simple operation; and low maintenance costs. The tools are operated by air from a common backhead, the air pressure being adjusted so that the tools stall at the required torque, and all nuts are run to precisely the same degree of tightness. The torque uniformity thus obtained is so accurate that subsequent torque checking operations can be eliminated. A new heavy-duty electrically driven compressor will also be displayed, which is available in sizes ranging from 125 to 350 H.P. Booth 1639.



Universal "Burr-Master" for Chamfering Hypoid Pinion Teeth

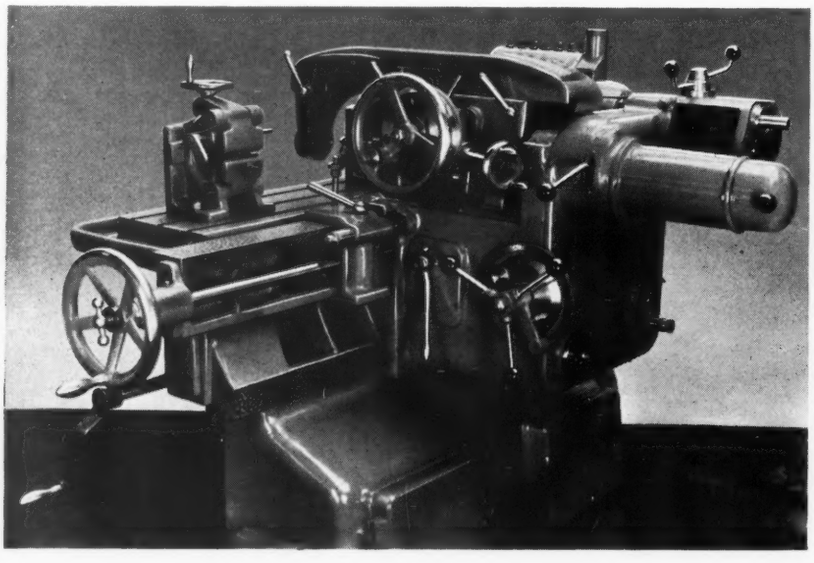
A universal "Burr-Master," designed for high-speed chamfering of hypoid pinion teeth, will be exhibited by the Modern Industrial Engineering Co., 14230 Birwood Ave., Detroit 4, Mich. Elimination of the need for skill in operating this new machine is an outstanding feature. Other features include automatic clamping and locating of work; chamfering of the sharp profiles at both ends of the teeth and part of the roots and acute corners on the peripheral chamfer section; and the capacity for handling pinions of different tooth numbers and diameters with only minor set-up changes. The output of this machine is up to 300 pinions per hour per head. Booth 1102.

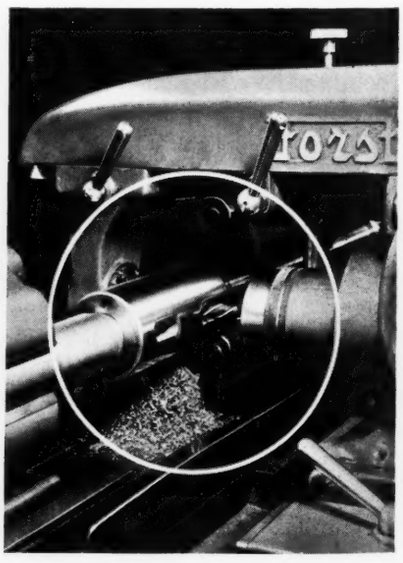
Bellows Air-Powered Drilling Device

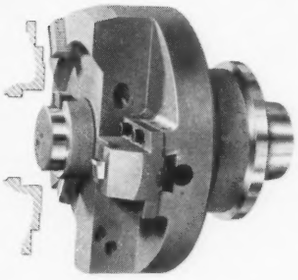
A unique drilling device will be shown for the first time at the exposition by the Bellows Co., 230-236 W. Market St., Akron 9, Ohio. This new unit, named the "Hydrair," is electrically driven, but air-powered, with the feed rate hydraulically controlled. Drilling capacity is 1/4 inch, with a maximum depth of stroke of 4 inches. Features include rapid advance, controlled feed, and rapid return. All controls are built in. Standard spindle free speed is 2800 R.P.M., and the rating 1/4 H.P., but a maximum of approximately 1/3 H.P. is developed at 1500 R.P.M. Five additional optional speed ranges of 17,000, 5000, 1450, 850, and 500 R.P.M. are available. The hydraulic feed rate control is adjustable from 0 up to 200 inches per minute at an air pressure of 90 pounds per square inch. Other new "packaged" Bellows "controlled-air-power" devices will be shown, including a torque-sensitive drill press feed which provides automatic drill cleaning for deep hole drilling; a "close accuracy" dial feed with a 22-inch diameter table top; and an air-powered shuttle fixture for faster work loading. Booths 1424-1428.

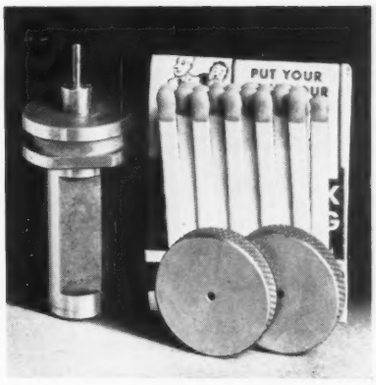
Forst Slot Milling and Keyseating Machine Introduced by Kurt Orban

The unique swiveling motion of the cutting spindle of the Forst slot milling and keyseating machine, to be exhibited by the Kurt Orban Co., Inc., 21 West St., New York 6, N. Y., permits the use of cutters that are of smaller diameter than the width of the desired slot or keyway. The use of the smaller-diameter cutters serves to compensate for errors in cutter size or machine operation. The swiveling motion is almost infinitely variable and is said to permit extreme precision in milling slots and keyways. This feature also results in a free cutting action, which tends to assure straight milling. Because the cutters are already under size, they can be reground, within certain limits, on the circumference, as well as on the front surface, and hence have a longer life. The machine will mill slots up to a maximum width of 0.787 inch and a maximum length of 3.14 inches, while keyways can be milled up to 0.984 to 1.41 inches wide by 29.5 inches long. Booth 1000.









Ex-Cell-O will Exhibit New Products

The Ex-Cell-O Corporation, Detroit 32, Mich., will display several new products for the first time at the show. Among these are jet-engine compressor blades and fuel nozzles. In addition to standard and special cutting tools and broaches, Ex-Cell-O's Continental Tool Works Division will exhibit new pine-tree form broaches for machining the slots in jet turbine wheels, and carbide-tipped form milling cutters developed especially for milling the airfoil form of jet blades, as well as the set of counterbores here illustrated. Precision grinding spindles and A.S.A. standard drill jig bushings will also be shown. Booth 1708.

Gairing Special Cutter-Head

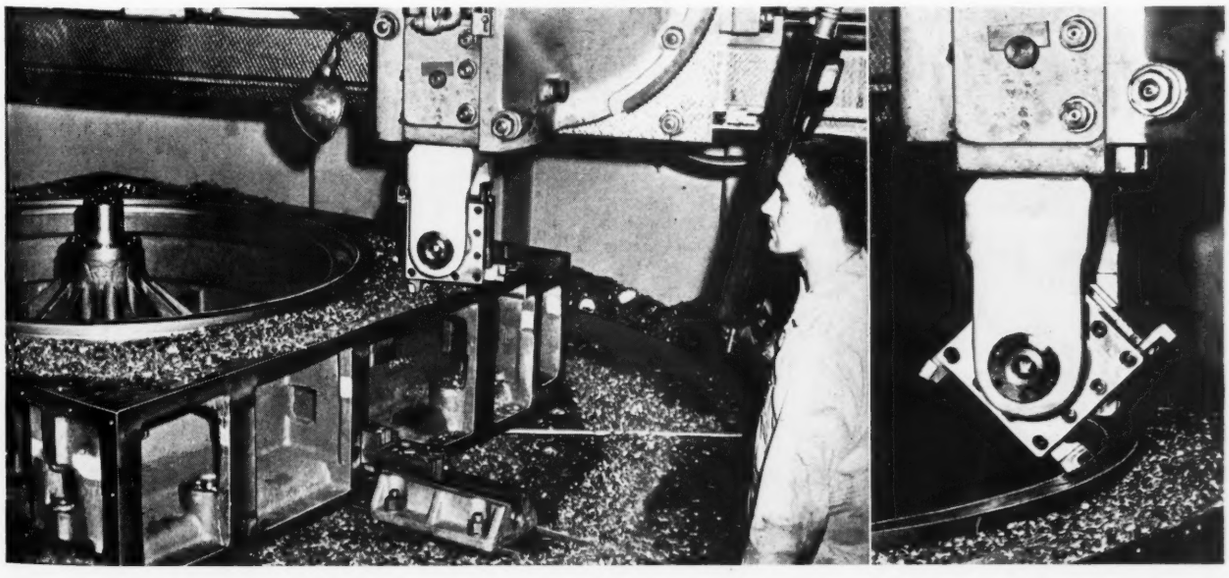
Outside of its lines of standard cutting tools, the Gairing Tool Co., Detroit, Mich., will show examples of special cutter-heads like the one illustrated. This cutter-head uses several tools, enabling a number of surfaces to be machined at the same time. Thus relative concentricity of diameters is assured, and machine set-up time reduced. The new cutter-heads are designed to combine simplicity with ease of adjustment. The bodies are built to take heavy feeds and to provide solid, positive support for the blades. The blades are of high-speed steel, hard alloys, or tungsten carbide, and are designed with correct angle, positive or negative rake, and proper projection from the body. They are replaceable at a fraction of the cost of solid tools. Booth 738.

Taft-Peirce Air Gage for Small Holes

How difficulties experienced in gaging small holes can be overcome with a new "Comp-Air-ator" introduced by the Taft-Peirce Mfg. Co., Woonsocket, R. I., will be demonstrated at this company's exhibition booth. The new gage utilizes the air-flow metering principle of measurement, which requires no building up of air pressure. This makes it possible to use very small air nozzles, which, in turn, permits the construction of very small gaging members. The typical gaging plug with "masters" shown in the illustration is designed for gaging holes only 0.058 inch in diameter. Flat plugs for slot measurements as small as 0.038 inch have also been made. The Taft-Peirce exhibit will also include a large line of fixed gages, air gages, tool-room equipment, and magnetic chucks. A continuously operating "Roto-Chek" power-driven thread gage will be on display. Booths 620-621.

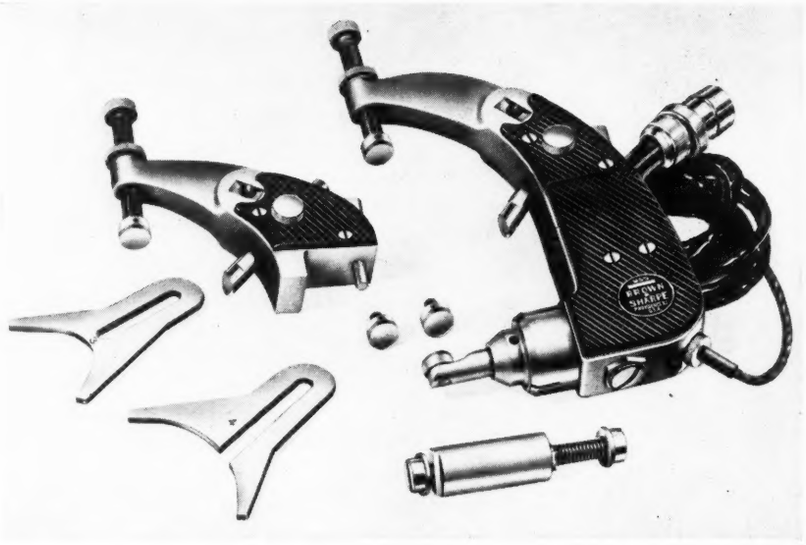
Davis Eight-Position Tool-Holder

A new eight-position tool-holder designed for use on vertical boring and turning mills will be introduced by the Davis Boring Tool Division of Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. This tool-holder enables an operator to turn, under-cut, bore, and chamfer in one set-up. Four tools can be mounted in the holder, and positive positioning of each tool is assured by two index-pins. The heavy cast-steel body of the holder is designed to assure accuracy. Only a simple wrench adjustment is required to accurately index the holder through 360 degrees in increments of 45 degrees. A center pin locks the complete assembly in rigid alignment. Less time required for set-ups and increased production are advantages claimed for this new holder. Booth 1705.



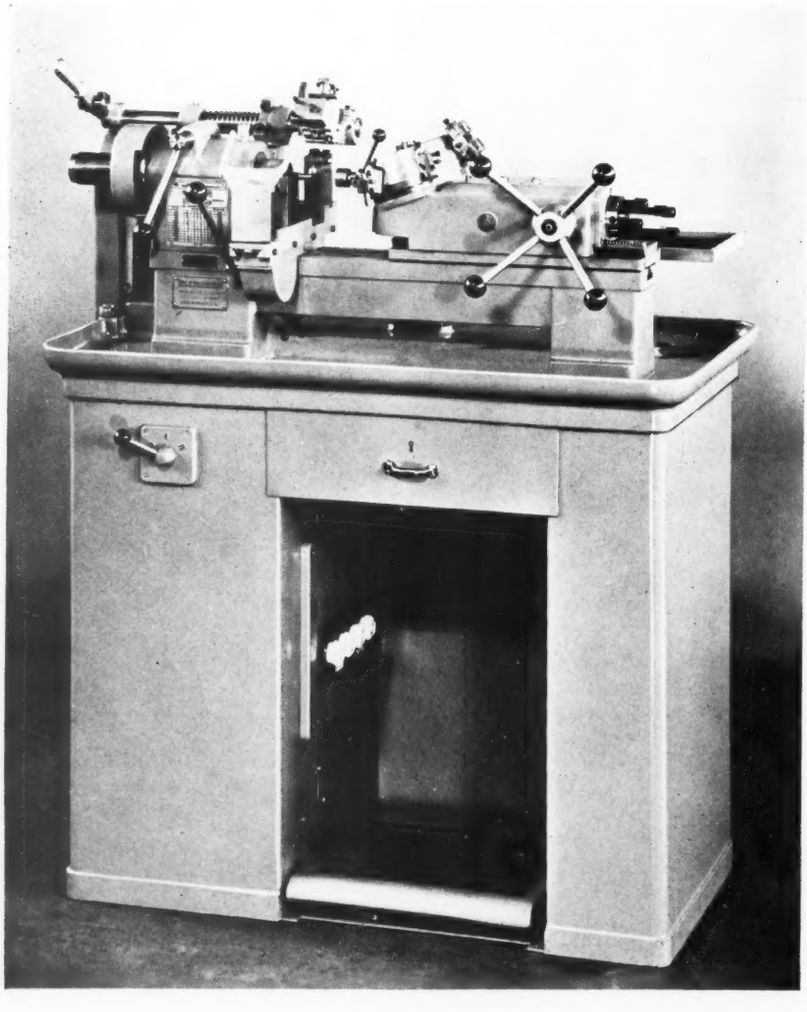
Brown & Sharpe Electronic Caliper Gage

The complete line of small tools, cutters, and precision measuring and gaging equipment to be exhibited by the Brown & Sharpe Mfg. Co., Providence 1, R. I., will include a new electronic caliper gage with provision for adjusting the measuring pressure. Among other equipment to be shown are the new Brown & Sharpe micrometer calipers having a stainless-steel spindle with hardened and ground threads, carbide measuring faces, and other advanced features; precision measuring tools; Johansson gage-blocks and accessories; photographic enlargements of electronic inspecting, sorting, and gaging equipment with manual and automatic loading; arbors, adapters, and collets; permanent-magnet chucks; screw machine tools; surface plates; and bench centers. B & S rotary geared, vane, centrifugal, and motor-driven pumps will also be shown. Booth 1435.



Kuhlmann Precision Lathes

The Kuhlmann precision hand turret lathe here illustrated is one of a line of machines to be exhibited by Eric R. Bachmann, 27-11 Forty-First Ave., Long Island City 1, N. Y. Production and tool-room models of this machine will also be shown. All three models of these Kuhlmann lathes have a cast-iron bed on a welded steel cabinet. The motor is of the two-speed type, and can be instantly reversed by actuating a foot-pedal. This feature is especially useful on threading operations. Twelve spindle speeds ranging from 156 to 8000 R.P.M. are available. The turret lathe shown has a six-station self-indexing turret with 5/8-inch bores. A special design allows the automatic indexing of three, four, five, or six stations per revolution of the turret head. All working controls of the lathe are actuated by a single lever. The production lathe features the same headstock with single-lever control. A four-station indexing toolpost and a swing bar stop are available as special equipment. Also a rear toolpost and a special threading attachment for a single-point tool can be supplied.



Other machines to be shown by Eric R. Bachmann will include a Reichle & Knoedler surface grinding and planing machine, on exhibition for the first time in this country. This grinder features a reversed cup grinding wheel, which is embedded in a hardened and ground rectangular-shaped table. The grinding cup is mounted directly on the motor spindle, and the motor, with all its controls, is placed in the machine base. A straightedge guides the hand-fed work-pieces across the cup-wheel, which is set at a slight angle. Wet grinding and dust removing equipment are available.

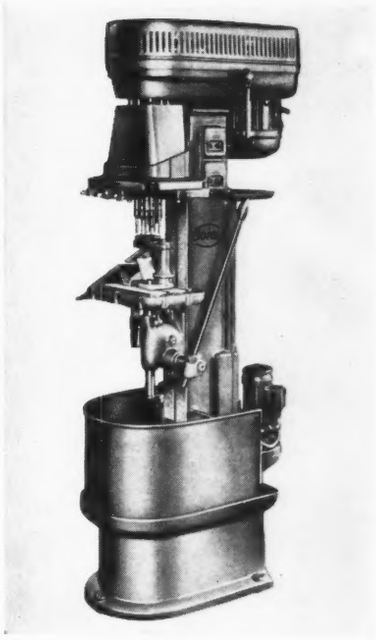
A Nothelfer micro-milling machine will also be exhibited. This universal milling machine has a protractor-shaped half-circle member with a dovetail cross-section which guides the milling head unit around a 90-degree arc. The milling head unit can be locked on the protractor guides in any desired position from the vertical to the horizontal. The 3 1/2 by 8 5/8 inch table is movable in all three directions by either feed-screws and crank or quick-action levers. Spindle speeds range up to 4000 R.P.M.

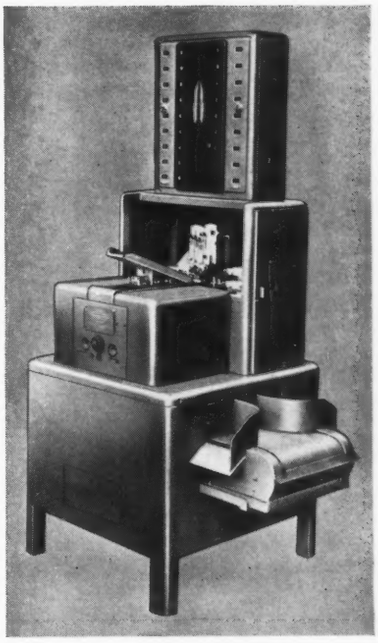
An Anthes & Gebhardt heavy-duty column type boring and drilling machine represents still another Bachmann exhibit. This machine has a completely enclosed 3-H.P. drive. A new stepless spindle speed selector makes available

the most efficient speed for each particular material and tool used. Tapping on this machine is extremely simple, as it is regularly equipped with depth stop and push-button for motor reverse. Booths 1817 and 1819.

Boley Multi-Spindle Drilling and Tapping Machines

Boley multi-spindle machines of the type illustrated will be introduced by the Cosa Corporation, 405 Lexington Ave., New York 17, N. Y. These machines can be used for drilling, countersinking, and tapping. They are suitable for series and mass production of machine or equipment parts from steel, cast iron, brass, copper, bronze, light alloys, ebonite, synthetic resins, and plastics. The maximum number of spindles is 10 or 13. When using the machine for drilling only, the reversing mechanism is cut out and locked by means of a lever. Drilling and countersinking, on the one hand, and tapping, on the other, must be effected in two separate operations. Booth 1750.



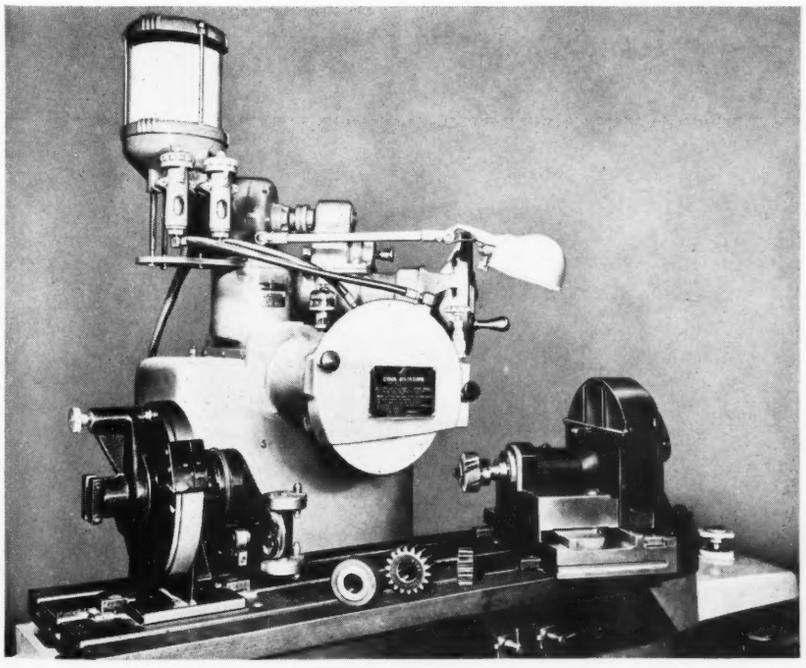


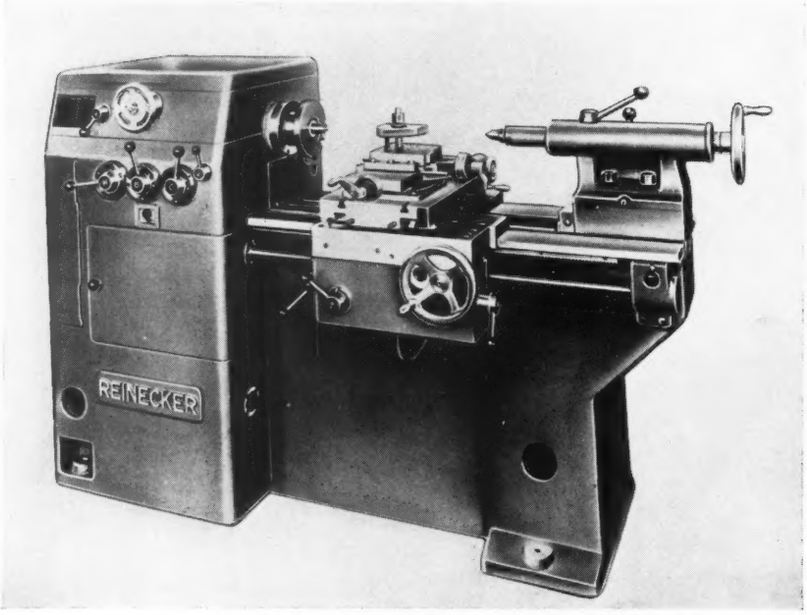
Sigma Automatic Inspection, Sorting and Tabulating Machine

This Sigma fully automatic inspection, sorting, and tabulating machine designed to check internal and external dimensions of parts, will be demonstrated by the Cosa Corporation, 405 Lexington Ave., New York 17, N. Y. The parts are fed into the machine automatically, and all dimensions are inspected simultaneously. After inspection, the parts are discharged on a conveyor belt, where they are divided into lots of accepted and rejected pieces and pieces that can be salvaged. The tabulating box also records the number of times each dimension gaged shows a plus reading (or reading above the basic size) and the number of times it shows a minus reading. This feature shows the inspector at all times whether any particular dimension is running toward the plus or minus limit of the tolerance. Up to 3600 pieces can be inspected per hour. Change-over for inspection of a different piece requires only twenty minutes. The machine illustrated is equipped to inspect eleven dimensions of a 20-millimeter shell. Booth 1750.

DoAll to Demonstrate New Methods and Tools

Visitors to the exhibit of the DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill., will see for the first time gears generated completely on the DoAll surface grinder with a gear generating attachment. This unit produces all types of gears up to 6 inches in diameter, with any pressure angle desired and any number of teeth up to 100. One simple set-up only is required. These gears can be ground from the solid or precut as desired without using base cylinders, masters, racks, etc. The only accessories needed are a sine bar and gage-blocks. The "Cool Grinding" process, developed to prevent checks, burns, and cracks, will also be demonstrated. A new plastic wheel guard makes visible the actual flow of coolant through the grinding wheel to the point of contact on the work. Gage-blocks and accessories will be demonstrated in the "Dimensional Quality Control" section of the company's exhibit. Featured is a new DoAll interferometer capable of measuring four billionths of an inch. A new mobile inspection unit, monolight, and plastic gage-block case, along with "Do-All Blocks," comparators, granite surface plates, optical flats, micrometers, and plug, cylindrical, and thread gages, will be included in the exhibit. In one section of the exhibit will be shown a complete line of cutting tools and industrial supplies; in another section, DoAll band tools for sawing, filing, grinding, and polishing any material; and in still another the "Contour-matic" and the "Super Zephyr" band machines. The latter machines will be seen in operation, cutting many different types of materials. Booth 1634.





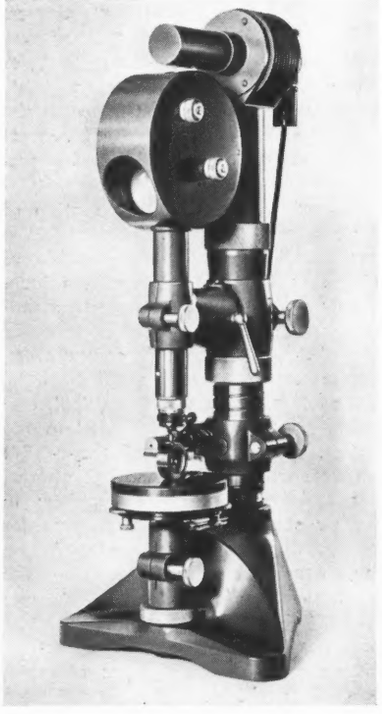
Reinecker Relieving Lathe

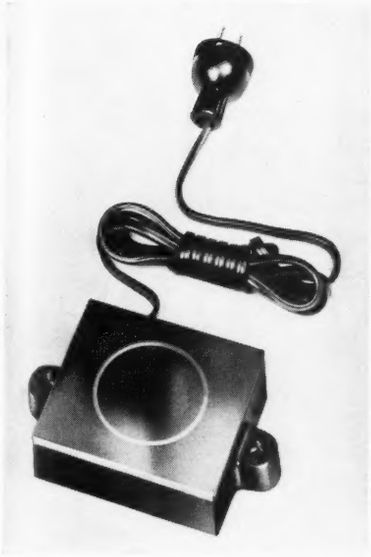
This redesigned Reinecker relieving lathe incorporating an entirely new principle in turning that is said to triple the operating speed of previous models, will be demonstrated in operation at the exposition by the Kurt Orban Co., Inc., 205 E. 42nd St., New York 17, N. Y. The three groups of independent change-gears in the lathe transmission system greatly simplify operation of the machine. Combined in the headstock are the spindle speed gears and the change-gears controlling the thread pitch, number of chip flutes, and lead of chip flutes. Forward and backward motion of the tool compound rest is positively controlled, permitting a greater number of strokes—up to 270 per minute—compared with previous models. The stroke length can be varied from 0 to 5/8 inch without changing plate cams. Attachments designed to extend the utility of this lathe include a relief-grinding unit which is tiltable in three planes and contains a built-in drive motor for the spindle and a newly developed grinding wheel dresser which permits the wheel to be dressed without removing the spindles from the machine. Booth 1000.

Precision Measuring Instruments to be Exhibited by the George Scherr Co.

A Leitz "Projectometer"—a precision measuring instrument of vertical construction for optically gaging lengths and thicknesses of small parts—will be shown by the George Scherr Co., Inc., 200 Lafayette St., New York 12, N. Y. This instrument, shown below in view at left, has a measuring scale with 0.00005 inch graduations and a plus or minus range of 0.005 inch. It is designed for measuring within plus or minus 0.000005 inch; has a throat depth of 4 inches; and will take work up to 8 inches in height. The instrument is also available in a projection type for reading the scale on a ground-glass screen with superimposed magnifying lens for production gaging.

The Leitz surface measuring instrument, shown in the view at the right, will also be exhibited. This instrument, is designed to permit examination of surfaces in the orthodox way, as well as to provide means for measuring geometrically to a high degree of accuracy the roughness or surface quality of work-pieces. The Forster process of measuring a profile by traversing the surface of the specimen under a very fine "jumping" or vibrating feeler point is employed in this instrument. The succeeding positions of the feeler are continuously recorded to show the variations in the surface by means of optically magnified light bands. With this method, tangential forces on the tracer point are practically avoided, and the finest sapphire points can be used. In addition to its regular line of gages, the George Scherr





Co. will exhibit for the first time a new model "Comparitol" comparator gage; jig borer reading to 0.00005 inch; indicating bore gages; indicating straddle gages for large diameters; indicating snap gages; "Perflektometer" for direct internal measurements; and "Ultra Projectometer" reading to 0.000010 inch. Booth 601.

Viking Small-Sized Magnetic Chucks

Small-sized magnetic chuck designed to concentrate deep magnetic holding power in a small, compact area, in order to speed precision grinding of small pieces. This is one of two new magnetic chucks to be introduced at the exposition by Viking Industries, 220 Montague St., Rockford, Ill. The new units have small, rectangular steel surface plates, precision-ground parallel with the mounting base. Both units operate equally well in either a horizontal, angular, or vertical plane. Operation is from 6-volt direct current, rectified from a standard alternating-current circuit. The Model G4 chuck shown has a 3 5/8-inch surface plate and a height of 1 5/16 inches. The G4A chuck has one-third greater holding power. Booth 1208.

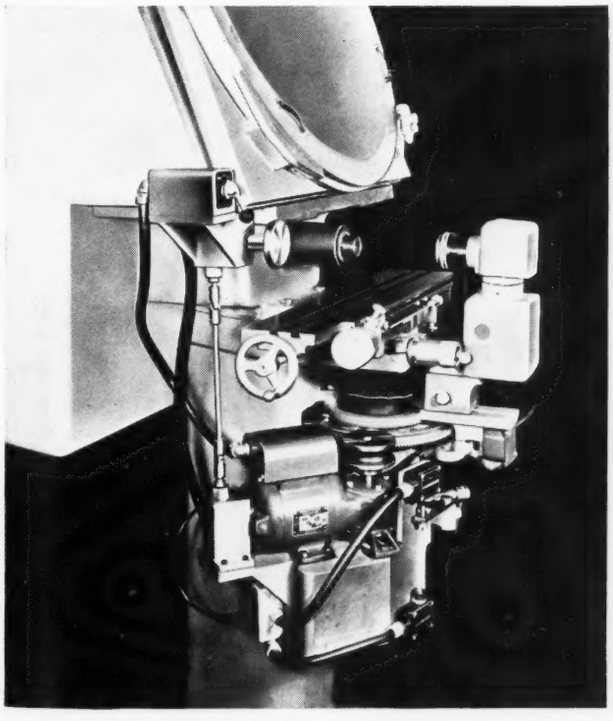
Geneva Precision Dial Indicator

Jeweled bearings comparable to those of a precision timepiece are said to be features of the new Model 145 Geneva indicator. This instrument is designed especially for checking variations in

contour, dimensions, or roundness to 0.0001 inch. Other dial indicators, magnetic base holders for indicators, special precision measuring instruments used by optometrists and engravers, and an instrument that can measure the hardness of a human eyeball are other products to be exhibited by the Chicago Dial Indicator Co., 180 N. Wacker Drive, Chicago, Ill. Booth 511.

Power Elevation and Tracing Attachments for J & L Comparators

Power elevation of the table by a self-contained motor-driven attachment shown in the illustration at the left will be a feature of the optical comparators to be exhibited by Jones & Lamson Machine Co., Springfield, Vt. This attachment is designed to raise or lower the table much faster than it can be done by hand. A tracing attachment, seen in the illustration at right, which provides a means for inspecting surfaces that cannot be projected or reflected, will also be exhibited. The illustration shows this attachment arranged for the inspection of a component of an automatic transmission unit. A special lens for projecting the complete contour of any object contained within a circle 6 inches in diameter on a screen 30 inches in diameter for accurate measurement or direct comparison will also be shown. The exhibit will include demonstrations of a wide range of threading equipment, including new die-heads. Booths 1411-1417-1425.

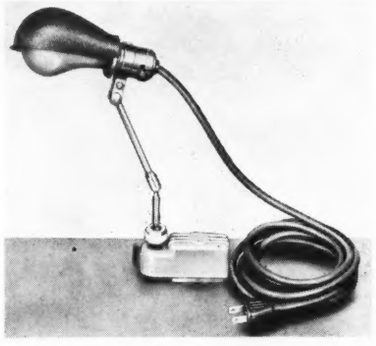


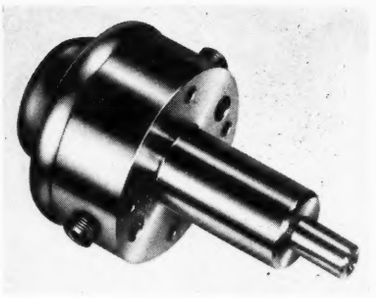
Federal Automatic Sorting Gages

Automatic sorting gages will be demonstrated by the Federal Products Corporation, 1111 Eddy St., Providence 1, R. I. The illustration above shows a row of the new Model 144 B-16 semi-automatic mica sorting gages, designed to measure and sort pieces of mica into eight acceptable classification groups, plus over-size and under-size groups, at a minimum gaging speed of 60 per minute. This gage will handle work-pieces up to 4 inches square. Tests indicate that it is capable of measuring up to 100 pieces per minute. Many other instruments will be shown, including the Federal pressureless measuring gage. This fast-response gage is designed for visible dimensional control of delicate parts without imposing a load on the work. The new "Dimensionair" high-pressure air gage will be demonstrated under production conditions. Several other types of "Dimensionair" set-ups will be shown, including a new contact type of adjustable air snap gage, designed to eliminate rocking action. There will also be an automatic "Eccentricator" demonstrating unit, which can be used in connection with automatic sorting according to specified eccentricity limits. Another automatic gage, called the "Electricator," which can be applied to the automatic control of machine feeds and the operation of signal lights or sound signals, will be shown. Booth 733.

Magnetic-Base Light-Holder

"Miti-Mite" portable magnetic-base holder for standard incandescent light bulbs up to the 100-watt size, to be introduced by the Enco Mfg. Co., 4522-26 W. Fullerton Ave., Chicago 39, Ill. This lighting unit can be instantly attached to curved or flat iron and steel surfaces. The base is 1 by 1 5/8 by 4 inches in size, and has a magnetic pull of 100 pounds. It can be instantly released for repositioning of light by operating a finger-tip lever. A magnetic-base holder for magnifiers and dial indicators will also be shown, together with a new portable demagnetizer. The company has also planned to have on display its complete line of lathe turrets. Booth 610.



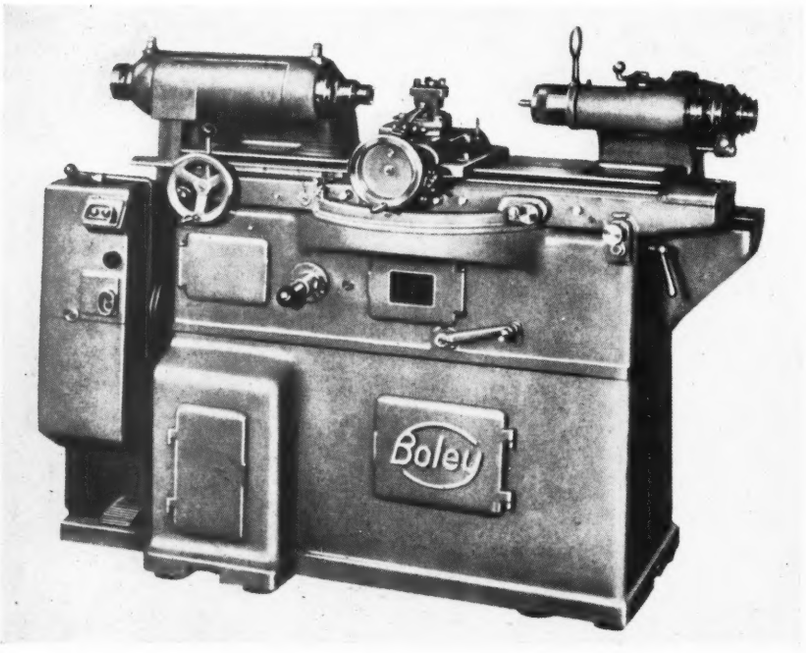


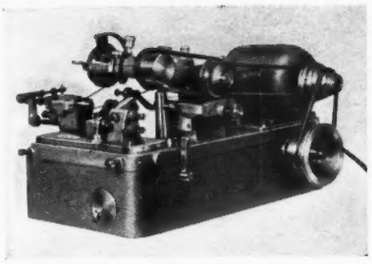
Tuthill Automatic Reversing Pump

One of the outstanding exhibits of the Tuthill Pump Co., 939 E. 95th St., Chicago 19, Ill., will be the new Model RF automatic reversing pump here illustrated. This pump has an outside diameter of only 2 1/2 inches, and a length of 4 1/4 inches. It will deliver a constant flow from the same port, regardless of the direction of shaft rotation, without the use of valves. This pump is especially suited for lubricating and hydraulic service in connection with machine tools and attachments. Available in three sizes, with capacities up to 2 gallons per minute and pressure ranges up to 200 pounds per square inch. Other features of the pump include external and internal porting and ring or flange type mounting. These and other Tuthill pumps for the tool industry will be on display in Booth 2029.

Boley Micro-Finish High-Precision Lathe

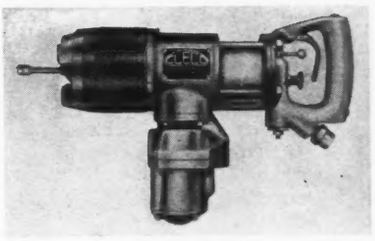
Micro-finish high-precision Model DW4 lathe for turning cylindrical, as well as conical surfaces with diamond tools and carbide bits, which will be exhibited by the Cosa Corporation, 405 Lexington Ave., New York 17, N. Y. This lathe is designed to produce a surface finish of very high quality and exact tolerances. It is specially suited for working on aluminum and its alloys, brass, bronze, babbitt, gray iron, hard rubber, etc. The micro-finished or micro-bored parts are ready for assembly without grinding or polishing. The scope of the lathe is considerably increased by a long, heavy table slide, mounted in a rotating unit, as in a cylindrical grinder. A large variety of jigs is available, which can be fitted to the table slide for boring-bar work, copying operations, special turning jobs, finishing spherical surfaces, etc. There is a special motor for driving the tailstock spindle to avoid heating the center and the work, so as to eliminate variations in length of work and damage to the tailstock center. The drive to the work-spindle and the feeds is vibration-free, no gearing being used. The motor, with push-button controls and brake, forms a unit that is separate from the machine. Booth 1750.





Sallaz Burnishing Machines

A new semi-automatic burnishing machine developed by Sallaz, Switzerland, is being shown by the Cosa Corporation, 405 Lexington Ave., New York 17, N. Y. This machine contains an automatic cycle unit in its base which enables one operator to tend two or three machines at the same time. The workpiece is inserted manually in the chuck and work-rest. The flip of a switch starts the semi-automatic burnishing cycle, which can be timed for a period of from three to twelve seconds. When the cycle is completed, the arm lifts the burnishing wheel off the work, and the drive-motor stops. Small bearings can be burnished to an accuracy of 0.00005 inch. Booth 1750.



Cleco "Airmatic" Countersink

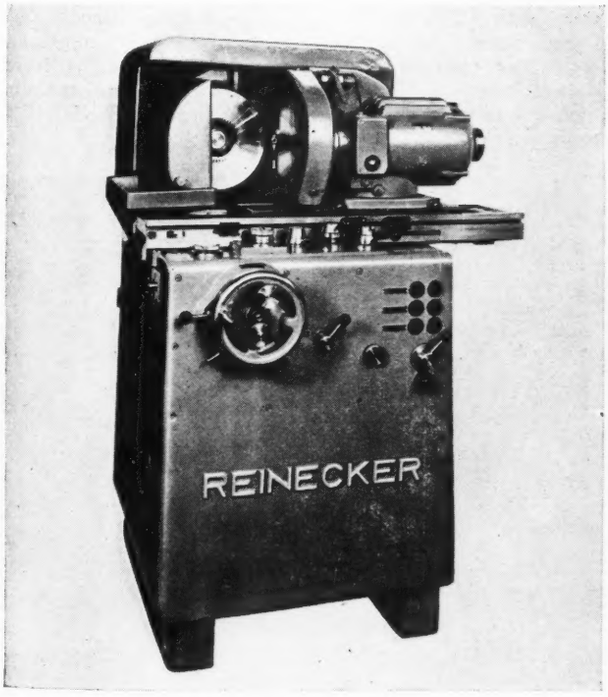
"Airmatic" countersink to be exhibited for the first time at the show by the Cleco Division of the Reed Roller Bit Co., 5125 Clinton Drive, Houston 20, Tex. This air tool was designed for metal fabricators. It will countersink a 3/8-inch hole in 75-ST aluminum in nine seconds, and will give comparable service in 27-ST aluminum, as well as alloy steels. The tool is designed to be self-supporting and easy to operate. It has only two controls, one for clamping the tool to the work and one for rotation. A built in micrometer gives accurate adjustment of the standard bayonet type countersink, and a built-in lubricator is used to assure trouble-free operation. Mandrels for varying hole diameters and countersinks can be changed rapidly without dismantling the tool. Booth 413.

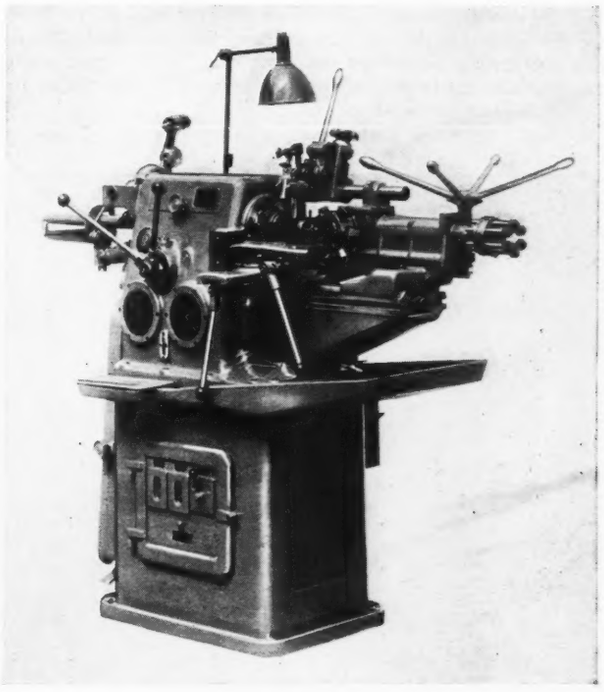
Reinecker Rotary Face Grinder

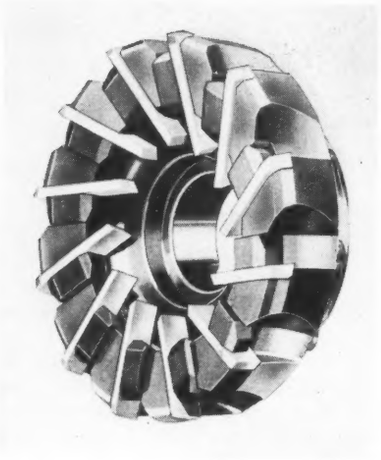
This Reinecker rotary face grinder, designed for the precise grinding of space rings, pump wheels, disc type control valves, and other work, is being introduced at the exposition by the Kurt Orban Co., Inc., 205 E. 42nd St., New York 17, N. Y. Both the work spindle and the grinding spindle of the machine can be tilted in a vertical plane, making it equally adaptable to the grinding of gear-shaper cutters, saw blades, shearing knives, and similar parts. The work-pieces, ranging from 1/2 inch to 10 inches in diameter by 6 inches in height, can be held by magnetic, collet, or jaw type chucks. A special feature of this grinder is the provision for semi-automatic grinding of hidden surfaces. Short grinding cycles and high efficiency are made possible by the use of a grinding wheel 10 inches in diameter, with rugged bearings. The sparking out period is variable, and the spindle can be adjusted to within 0.000039 inch for correction purposes while the machine is working. Tolerances from face to face of the work can be held within 0.00004 to 0.00008 inch, depending on the type of operation. Booth 1000.

Hand-Feed Precision Turret Lathe

Extreme precision in machining operations and an unusual degree of simplicity in setting up are features claimed for the Hestika Model HR 26 turret lathe which will be shown by the Kurt Orban Co., Inc., 205 E. 42nd St., New York 17, N. Y. This lathe is particularly adapted for the economical production of single pieces or short-run work to very close tolerances. The short-throw turret hand-feed makes it possible to economically employ short machining cycles in the production of formed parts from bar stock, turning of cast or pressed components, and finishing or second operations on pre-machined work. The turret can be used with three, four, five, or six tools. One or more drilling spindles may be set up on the turret tailstock for drilling small, accurate holes. Readily interchangeable attachments permit carrying out a wide range of machining operations. The lathe has a bed length of 23 1/2 inches and a maximum collet capacity of 1 inch. Spindle speed ranges are as follows: High speed, 390 to 2400 R.P.M.; thread-cutting, 43 to 270 R.P.M.; reversing, 130 to 800 R.P.M. Booth 1000.





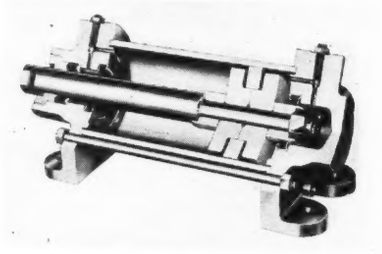


Air Cylinder with Flexible Cushion Sealing

One of a new line of "Super Cushion" air cylinders with a revolutionary application of flexible cushion sealing, to be introduced by the Tomkins-Johnson Co., Jackson, Mich. This flexible cushion seal is said to insure positive cushion action, combined with automatic valving action for fast return stroke, and the elimination of binding and sticking. Although wear on the sealing element is said to be practically non-existent, any possible wear is automatically compensated for by the "sealing with pressure" characteristics of the new seal. A metallic rod wiper ring affords permanent protection from dirt and grit. The cylinder is designed for safe operation at an air-line pressure of 100 pounds per square inch. It is available in seven standard styles for all types of mounting requirements, with capacities from 100 to 12,000 pounds for power movement in any direction. Booth 1927.

Kennametal Improved Milling Cutter

Improved milling cutter, designated "Style KF Kennamill," to be shown by Kennametal, Inc., Latrobe, Pa. This cutter is designed primarily for production milling runs on steel work where adequate horsepower is available and where intermittent or narrow cuts are encountered. It is also well suited for heavy cutting of cast iron. The cutter has only four parts—the body, blades, wedges, and nuts. The blades are interchangeable in all slots of any size of cutter body of the same type. Wedges are round, and are also interchangeable in any slot of any size cutter, either right- or left-hand. Cutters available in 6, 8, 10, and 12 inch sizes. Booth 1723



Nilco Dial Groove-Locating Gage

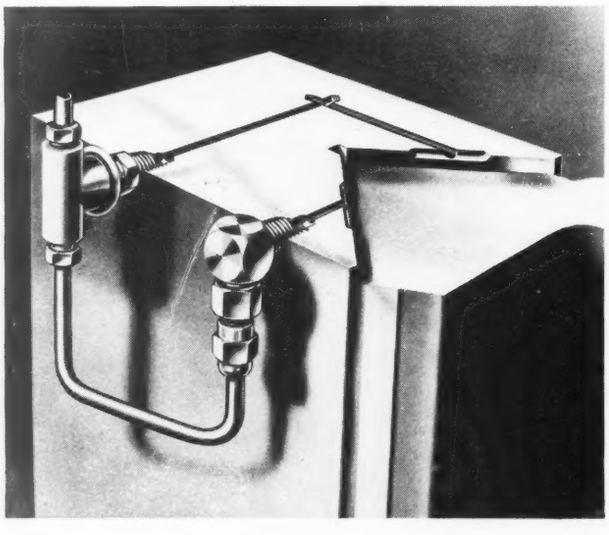
Outstanding exhibits of the Nilsson Gage Co., Inc., Poughkeepsie, N. Y., will include the new Nilco dial groove diameter gage and the companion dial groove location gage here illustrated. The combination of the two groove gages is said to provide a satisfactory solution to problems encountered by tool engineers in redesigning products for the use of the various types of improved retainer rings now available. Other products to be exhibited by the company at the show include a pistol-grip bore gage, carbide and chrome-plated gages of various types, crankshaft dial snap gages, and a wide range of internal and external gages. Booth 533.

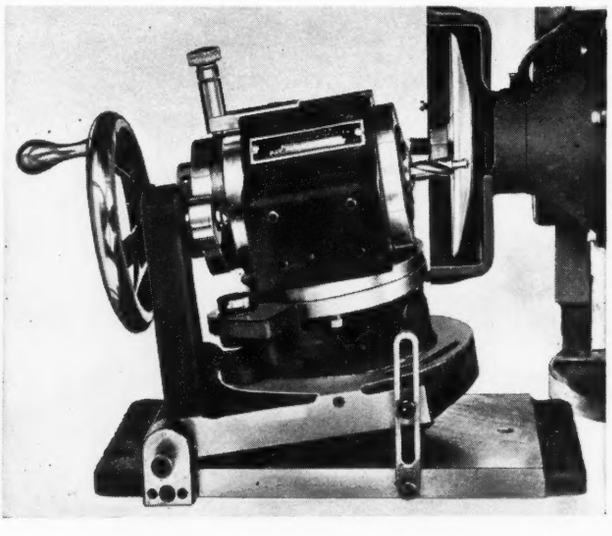
Bijur Slide and Way Lubricating Equipment

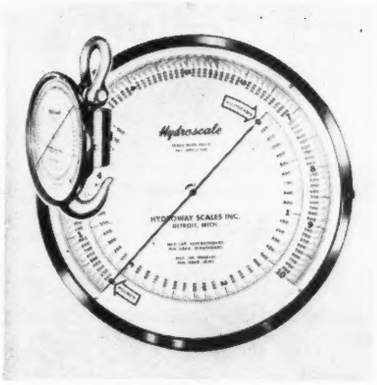
Equipment designed to solve the problems of proper lubrication of both vertical and horizontal V-slides, vertical guideposts, and horizontal dovetail ways will be demonstrated at the show by the Bijur Lubricating Corporation, Rochelle Park, N. J. The lubricating equipment used is always built integral with the machine, as in the case of the vertical V-slide shown in the illustration below. Booth 641.

Royal Oak Radial Relief Grinding Machine

D.S. radial relief grinder, to be displayed by the Royal Oak Tool & Machine Co., 621 E. 4th St., P. O. Box 111, Royal Oak, Mich. This machine is designed to produce a fine finish, permit cleaner, faster cutting, and give a greater number of cuts per grind and longer tool life. It is of rugged, simple design, and easy to set up and operate. Manual and motor-driven models will be shown. Booth 1101.







"Hydroscales" Weigh Loads as They are Lifted

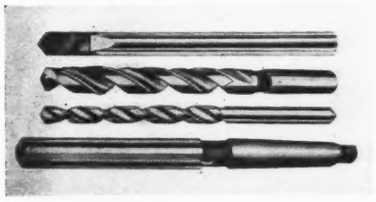
"Hydroscales" in standard models, with dials reading in pounds and also in kilograms for export trade; tilt-face models for high-level reading; and various accessories will be shown at the exposition by Hydroway Scales, Inc., 20624 W. Eight Mile Road, P. O. Box 4754, Detroit 19, Mich. Advantages include elimination of handling by weighing the loads as they are lifted by regular handling equipment; elimination of weighing stations where tie-ups occur; and closer checking at receiving and shipping stations. Models are manufactured in 12-, 24-, and 30-inch sizes, with weighing capacities of from 500 to 100,000 pounds. Booth 108.

Beaver Quick-Change Tool-Holder

One of a large line of quick-acting tool-holders to be exhibited by Beaver Tool & Engineering Corporation, Royal Oak, Mich. These tool-holders are designed for use in handling accurate work on all types of milling, drilling, and boring machines. A full line of adapters and boring-bars for holding standard cutting and boring tools is also manufactured by this company. These quick-change holders and adapters permit presetting the tools to the job, so that radial and endwise positioning of the tools will be automatically maintained when changing from one tool to another. Booth 1219.

Solid Carbide and Carbide Tipped Tools

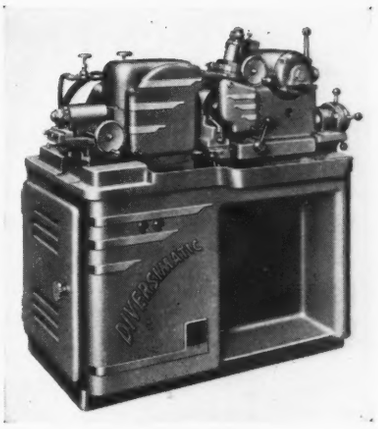
A complete line of tipped and solid carbide drills in regular and fast-spiral types will be included in the tools exhibited by the Super Tool Co., 21650 Hoover Road, Detroit 13, Mich. This company will also display its complete line of solid carbide and carbide-tipped milling cutters and reamers. Of special interest will be the line of standard



tools now available from stock in a range of tip brands which permits the user to select the kind of carbide tip best adapted to meet the requirements of his work. Booth 1429.

Vapor Blast Liquid Honing Equipment

Two new liquid honing machines will be shown by the Vapor Blast Mfg. Co., Milwaukee, Wis. The smaller of these machines (here illustrated) is especially adapted for tool-room use, while the larger one is equipped with a track and car for handling heavier work. Both machines are designed for use in honing broaches, hobs, taps, drills, and other tools, as well as larger work, such as dies and molds. Examples of tools before and after liquid honing will be exhibited, together with reports of results obtained by users. Booths 1210 and 1317.



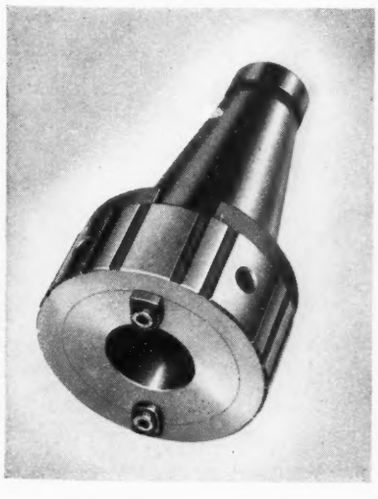
"Diversimatic" Precision Centerless Grinder

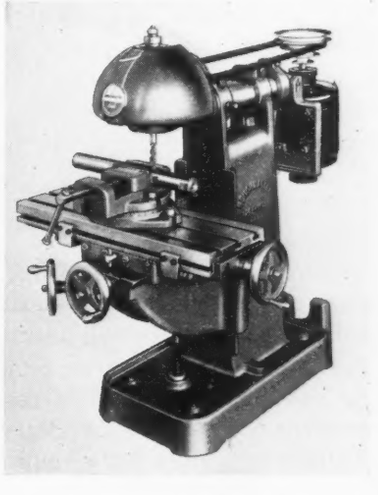
Precision centerless grinder designed to handle work from the very small sizes up to 1 1/4 inches in diameter. This machine, known as the "Diversimatic," will be introduced at the show by the Diversified Metal Products Co., 5138 Alcoa Ave., Los Angeles 58, Calif. It has a cool running spindle which is said to require no warm up period before starting production in order to maintain close tolerances. A 14- by 4-inch grinding wheel and a 7- by 4-inch regulating wheel are employed. Stepless adjustment of the feed-wheel speed range is from 30 to 350 R.P.M. Both wheels have built-in diamond dressing equipment. The machine handles both through-feed and plunge-feed work, producing micro finishes. The base measures 35 by 48 inches, and the height is 54 inches. The weight is about 3150 pounds. Drive motors of 2 to 5 H.P. are recommended. Booth 1239.

Benchmaster Milling Machines

Vertical milling machine, to be exhibited by the Benchmaster Mfg. Co., 1835 W. Rosecrans Ave., Gardena,

(Continued on page 213)





Precision Control—A "Must" for Security

(*Continued from Page 143*)

man-hours will be used in this phase of our production program. Thus it will be possible to release machine tools being used on peacetime work for production operations on military programs that are slowed up by the critical machine tool delivery situation. Every possible effort must be made to utilize available machine tools for military production programs. Precision control assures that each machine tool is producing the maximum number of parts that will meet specifications.

How Much Does Precision Control Cost?

Under a free economy, cost is always a factor in production programs. Recently, industry has again stated that it is a major factor. Its control equipment too expensive? The value of precision control equipment and methods depends entirely on the value of the rejected parts they avoid. When statistical control methods were first introduced, many felt that they were expensive. Yet industry has found that they pay for themselves many times over because of the assurance that a maximum number of parts can be produced within a close-tolerance range.

The factor that is often overlooked in evaluating the economies of installing adequate precision control equipment is the real cost of rejected parts. Just as economies of machine tool procurement are always based on the cost of the investment versus the value of the added productivity, so the savings resulting from the reduction in the number of rejected parts must be considered in deciding whether the use of precicion control equipment is justified.

Certainly at this time some may rightfully say that money is expendable, but materials are not. That may be the case, but it does cost money to salvage rejections and it costs even more money to produce rejections. All this is not mere speculation. The sound economics of providing precision control equipment has been clearly demonstrated in many manufacturing programs instituted since the end of World War II.

Without a doubt, the continuing development programs of precision control equipment manufacturers in the fields of electronics, hydraulics, and compressed air will assure even more accurate equipment at lower cost. Particularly in the field of electronics is cost reduction being achieved through the development of new metal-ceramic materials for circuit components.

How Will Adequate Precision Control Methods be Achieved?

The burden of instituting and furthering precision control methods falls—by definition—on the "tool engineer." One of his main functions is the constant review of existing production facilities to make certain that they operate with maximum efficiency. In this review procedure, studies can and should be made with a view to applying the latest precision control methods, so as to assure a minimum number of rejected parts and increase current productivity of many shops.

In providing new production facilities, the tool engineer should provide for the latest precision control equipment, and thus be certain that when the assembly line starts, a majority of the pieces will fit the end product as they come off the machines. Of course, tool engineers are always searching for better precision control equipment. Today, with more and more close-tolerance work being required at high production rates, they are constantly on the look-out for equipment that will assure precision control without reducing productivity.

Our Society is making an effort to highlight the importance of precision control equipment today and tomorrow by devoting an entire hall at the A.S.T.E. Exposition to exhibits of this type of equipment. Precision Control Hall will show the latest developments in inspection, quality control, and related equipment and methods. We have designated March 17, the opening day of the Exposition, as "Precision Control Day," and have organized a technical program and panel discussion for that day which will be devoted exclusively to topics related to precision control problems.

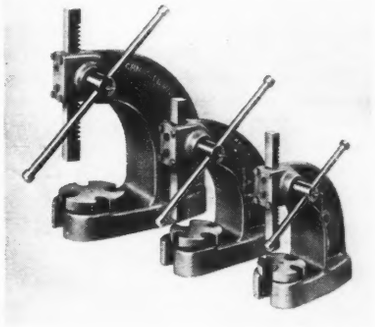
Precision control is truly a "must" for security. It can only be achieved by recognizing that it is, in reality, a major key to greater productivity. It assures that the maximum number of parts produced by our high-production methods will reach the assembly line with uniform accuracy and according to specification.

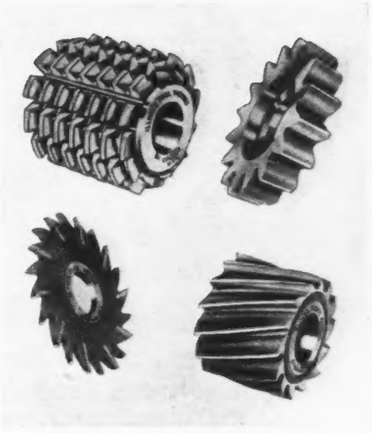
Precision control is a creation of the free world. If the free world does not exploit it to the point where maximum productivity is assured, our adversaries, even with less production "know how," can easily defeat us on the production front by sheer force of numbers alone.

Calif. This machine is also available in a horizontal model, so designed that it can be converted to the vertical type simply by changing the self-contained spindle assembly. The spindles of both models utilize Timken tapered roller bearings. The No. 2 Morse taper in both spindles accommodates the same accessories as are used on small lathes, such as chucks, arbors, etc. By using a Benchmaster toolpost block, threaded arbor, and chuck, the machine can be used for special turning operations that come within the range of a 23-inch swing. A 6 inch rotary table handles precision dividing jobs, and a swivel-base vise is also available. Booth 1805.

Benchmaster Arbor Presses

Increased work capacity, both in throat depth and in vertical space, and streamline design are features of this new group of three arbor presses, which will be introduced at the show by the Benchmaster Mfg. Co., 1835 W. Rosecrans Ave., Gardena, Calif. These Nos. 0, 1, and 2 size presses are all made in solid platen types, with either lever or pilot-wheel actuation. The base and column are integrally cast of high-strength semi-steel which, in combination with the design, is said to give a safety factor at least five times the regular rated capacity. The heavy steel rams and pinions have cut stub gear teeth, capable of withstanding heavy loads. Take-up adjustments are provided on both front and side of the ram. The three presses have maximum capacities over the table of 5, 6, and 9 inches, and will handle work having maximum diameters of 7 1/2, 10, and 13 3/4 inches. Booth 1805.





Hobs and Cutters to be Exhibited by Illinois Tool Works

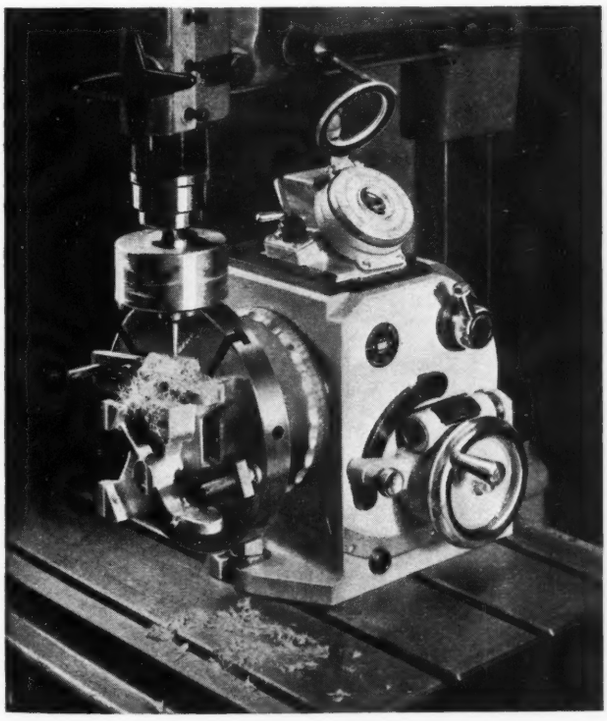
A wide variety of metal-cutting tools will be exhibited by Illinois Tool Works, 2501 N. Keeler Ave., Chicago 39, Ill. The display will include hobs, broaches, shaper cutters, milling cutters, form tools, and special tools. Booth 1223.

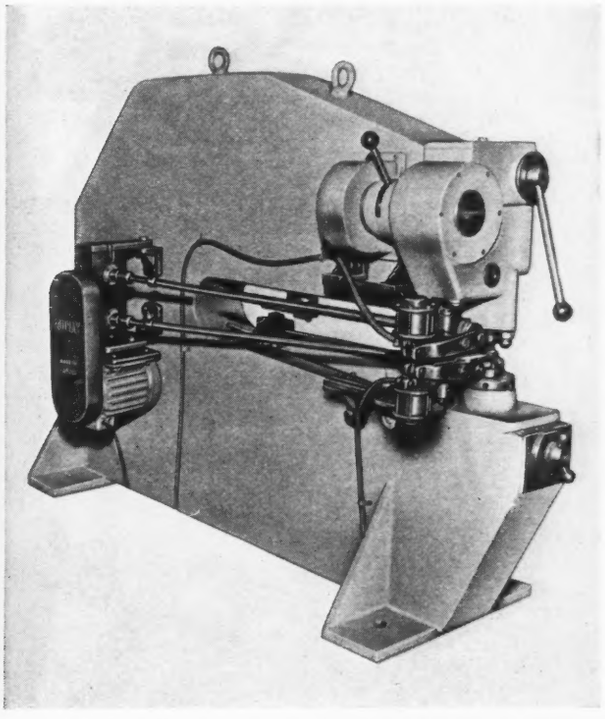
Griswold Optical Dividing Head

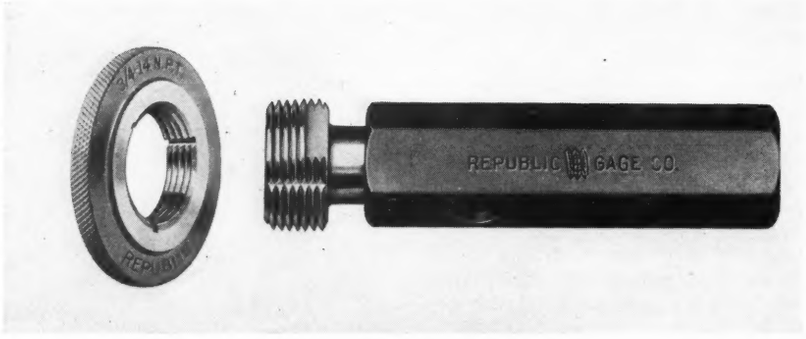
Precision dividing head featured in the complete line of optical tools to be exhibited by the F. T. Griswold Mfg. Co., Wayne 3, Pa. This company will show a number of new tools for the first time at the exposition, including two distinct types of alignment telescopes, an optional cam-rise gage, a level, and a drill "Point-Chek," all of which have been added to the line during the past year. These developments, together with the Griswold optical dividing heads, indexing table, straightedge, and "Scan-A-Scale," will be demonstrated at the show. Booth 832.

Power Feed for Sheet-Metal Machines

Pullmax sheet-metal working machine equipped with a power feed developed by the American Pullmax Co., Inc., 2455 N. Sheffield Ave., Chicago 14, Ill., for use on the Models P-5 and D 3 Pullmax Major machines to aid in cutting and working steel plate up to 11/32 inch thick. This device can be used for cutting discs and circles on a production basis. It has been designed to reduce manpower requirements, speed up cutting time, and eliminate vibration sometimes caused by hand feeding. High-speed wire straightening and cutting machines will also be demonstrated. Booth 1943.





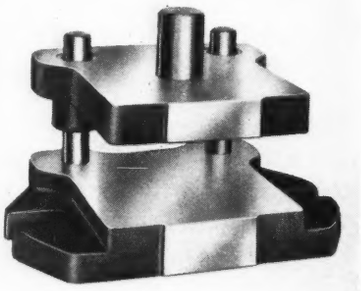


Republic Thread Gages with New Precision Features

Convoluting and chip-grooving are features of the thread plug gages to be exhibited by the Republic Gage Co., 2228 Fenkell Ave., Detroit 21, Mich. The advantages of such precision features as major diameter relief of thread ring gages and accuracy and finish of plain cylindrical plug and ring gages will be demonstrated. Republic "V-nide," "Carbide," "Norbide," and "Titan" gages will also be displayed. Booth 519.

Producto to Show New Die Sets

One of a line of die sets featuring six major improvements, to be exhibited by the Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn. Greater strength is obtained in the new design, with every contour planned to keep weight at a minimum while reinforcing all critical areas. One long, smoothly machined rear pad on the punch- and die-holders assures uniformly accurate location of pin and bushing holes. The straight rear pad also allows considerably more lay-out and mounting area on the punch-holder, as well as on the smaller die-holder. All semi-steel die sets have uniform grain structure and high tensile strength. The design is such that the tools are easily accessible. Booth 1104.



Erickson Exhibit to Include New Speed Indexer

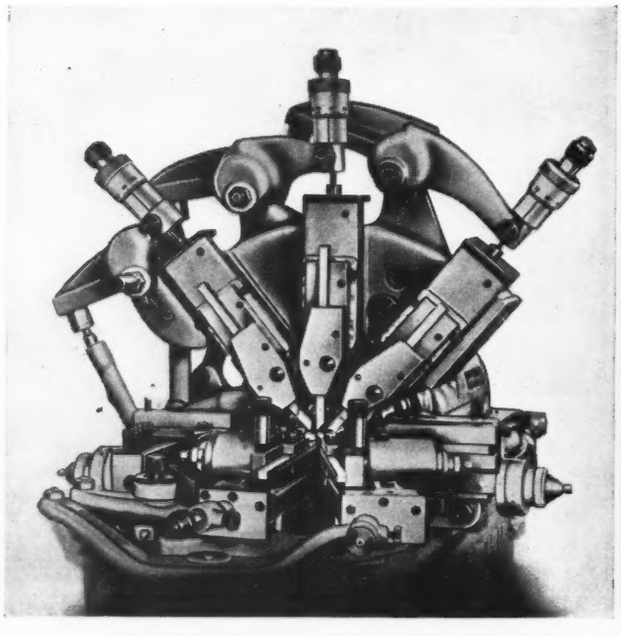
The Erickson Tools Division, Erickson Steel Co., Cleveland, Ohio, will have on display a milling machine operating in conjunction with an Erickson "Speed Indexer." This equipment will be set up for a fully automatic series of operations. The indexer can be either air or hydraulically operated, and is adaptable to meet a wide range of positioning requirements. Another operating unit that will be seen is a turret lathe equipped for automatic or semi-automatic operation through the addition of an Erickson air cylinder, which actuates a collet chuck. The exhibit will also include collet and other types of chucks, including drill, tap, and milling machine chucks; expanding mandrels; adjustable holders; Erickson-State boring-bars; reamer-holders; self-releasing tap-holders; and a wide variety of other tool equipment. The continuous operation of this equipment will afford an opportunity to compare different methods of handling a particular job. Booth 1127.

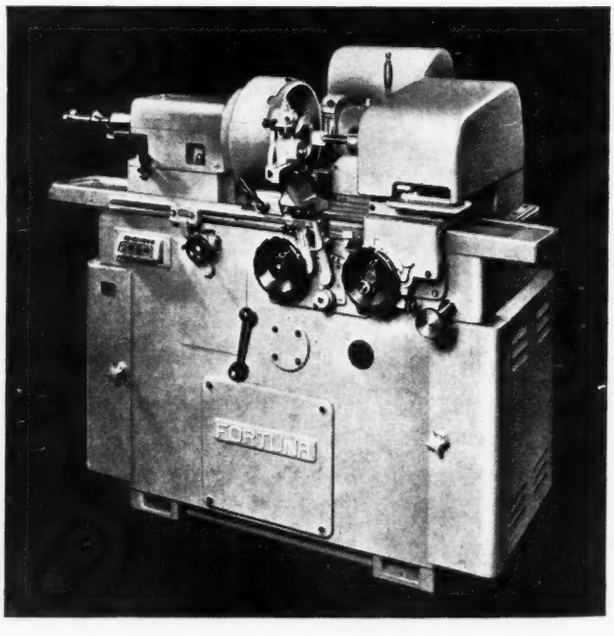
Bechler "Isomatic" Lathe

Precision turning of small parts up to 9/32 inch in diameter, including components of watches, instruments, etc., which must be held to extremely close limits of accuracy, can be accomplished on the Bechler "Isomatic," to be exhibited at the A.S.T.E. Show by the Cosa Corporation, 405 Lexington Ave., New York 17, N. Y. Booth 1750.

Fortuna Sip Grinding Machine

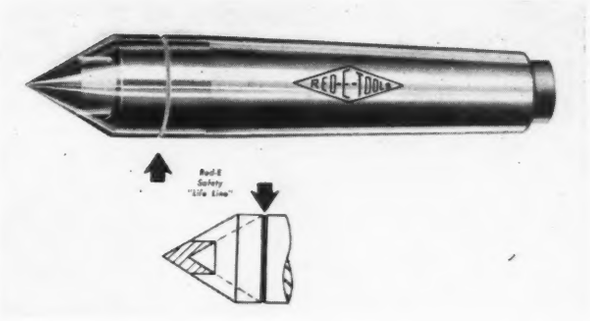
Two headstocks with spindles for performing internal and face grinding operations at one set-up; hydraulic feeds; and semi-automatic, cam controlled feed for production grinding when required are features of this Fortuna Sip machine, which is to be introduced at the show by the Cosa Corporation, 405 Lexington Ave., New York 17, N. Y. Booth 1750.





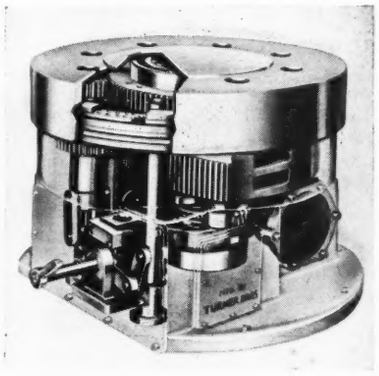
Red-E Carbide-Tipped Centers with Grinding Safety "Life Line"

Red-E carbide-tipped lathe center with grinding safety "Life Line" which indicates the maximum amount that the center can be safely ground. The center groove is accurately machined and painted bright red to guide the operator so that he will not grind the center beyond the safe limit. The insert is made of sintered tungsten carbide by the "hot-pressed" method to provide maximum useful life and resistance to abrasive wear. Other tools to be displayed by the Ready Tool Co., Bridgeport, Conn., include reversing dogs; cam dogs; and a center for 7-inch spindles. Booth 1017.



Mechanical Indexing Table

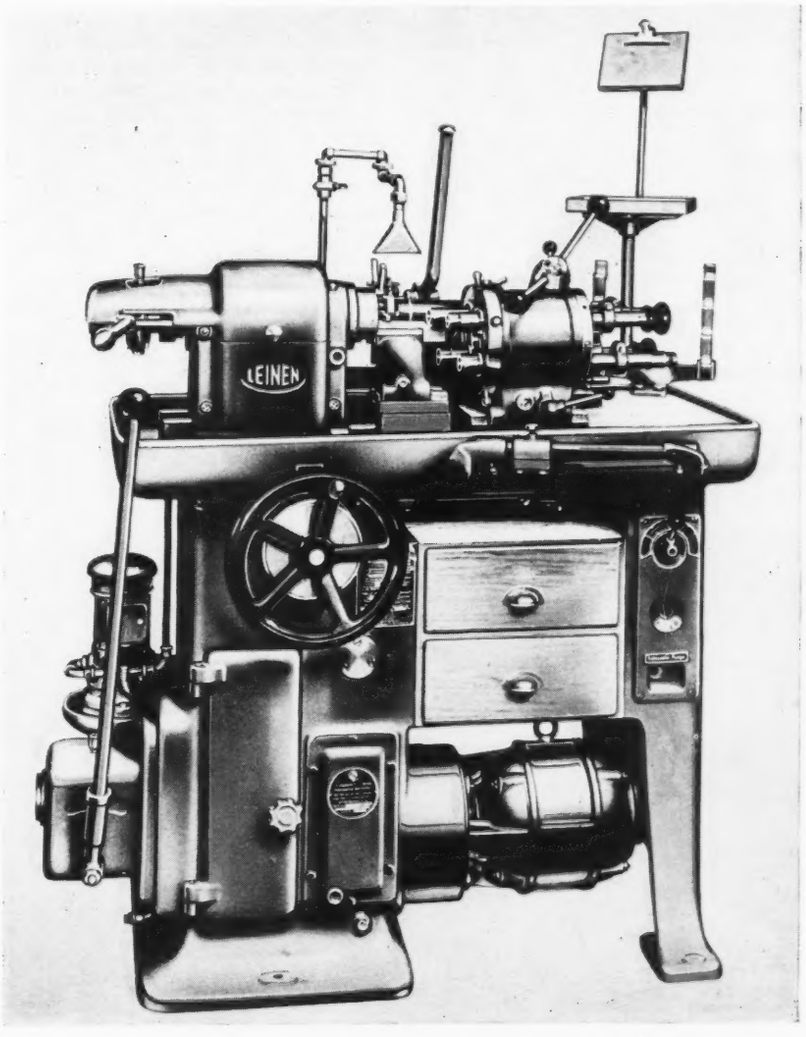
New mechanical indexing table, known as the "Hautau-Turndex," designed to move heavy loads from station to station in three-fifths of a second indexing

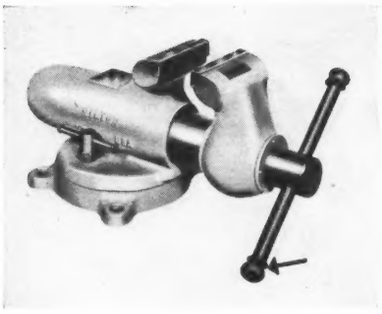


time. This unit, now being manufactured by Turner Bros., Inc., 2625 Hilton Road, Ferndale, Mich., will be demonstrated at the exposition. Every cycle of the indexing mechanism is controlled by the uniform gear-tooth area of a master sector gear. This gear establishes the basic and unvarying accuracy claimed for the indexing movements. A set of cams which control the master sector gear directly governs the acceleration and deceleration of the table, eliminating abrupt starting, stopping, or catapulting action. Only 1 H.P. is required to operate a 24-inch unit with an 800 pound work load on the table. Standard units are available with from two to twenty-six stations, in any equal division of 360 degrees, but the table can be adapted to a larger number of stations if desired, or applied as a driving unit for indexing larger rotary tables up to 12 feet in diameter. The table is being adapted for milling, drilling, reaming, boring, counterboring, crimping, stamping, and assembling operations. Two optional table-top designs are available—a table top that revolves as a single unit, and a table top that is divided into two sections, consisting of a revolving outside indexing section and a stationary center section. A machining unit can be mounted on the stationary center section for machining the work from the inside. This feature eliminates the need for massive, overhanging fixtures and columns. The design of the table top permits the machining of a part from all sides at the same time.

Leinen Precision High-Speed Turret Lathe

The Leinen high-speed turret lathe here illustrated is one of a line of precision tool-room and production machines to be exhibited by Guthery Machine Tool Corporation, 130 W. 42nd St., New York 18, N. Y. This lathe has a collet capacity of 1 1/32 inches; spindle bore diameter of 1 7/16 inches; turning length capacity of 4 5/16 inches; and maximum chucking diameter of 2 5/32 inches. Spindle speeds available in both directions are steplessly variable from 40 to 2400 R.P.M. A back-gear ratio of 1 to 10 makes it possible to obtain slow speeds for tapping, threading, and reaming. The turret can be supplied with six or eight tool positions. Other machines to be exhibited by this company include a Traub single-spindle automatic turning, drilling, and cutting off lathe, and Weisser Heilbronn high-speed production lathes. Booth 1827.





Wilton Vise with Shock-Proof Safety Handle

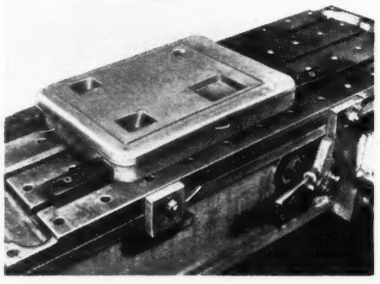
Rubber rings mounted next to the handle knobs prevent the pinching of fingers when using this new vise, which is to be shown by the Wilton Tool Mfg. Co., 925 Wrightwood Ave., Chicago 14, Ill. The rubber rings greatly reduce noise and jarring, and are oil- and grease-proof. The vise has interchangeable and reversible jaws, and is provided with a swivel base which can be locked in any desired position. Booth 237.

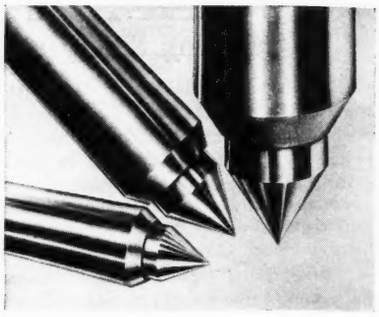
Norton Grinding and Finishing Equipment

New reinforced, flexible, hub type grinding wheel, known as the BFR, which will be included in the line of grinding and polishing equipment to be exhibited by the Norton Co., Worcester 6, Mass. This new wheel is designed for rough-grinding, finish-grinding, and notching, all with the same wheel. It is especially intended for use on right-angle or "sander" type portable grinders, and is made of carded web material impregnated with abrasive grain. Light weight, unusual strength due to a patented construction, and the proper amount of flexibility to permit blending of contours adapt this wheel to a wide range of polishing jobs. It can be used to smooth down welds, blend surfaces on contours, and notch risers in all kinds of castings. Should breakage occur, the web is designed to hold the pieces together until the machine is stopped. The Norton Co.'s exhibit will also include other types of grinding wheels, abrasives, and various refractory products. Booth 1039.

"Jumbo" and "Lil-Giant" Jaw Clamps for Holding Planer Work

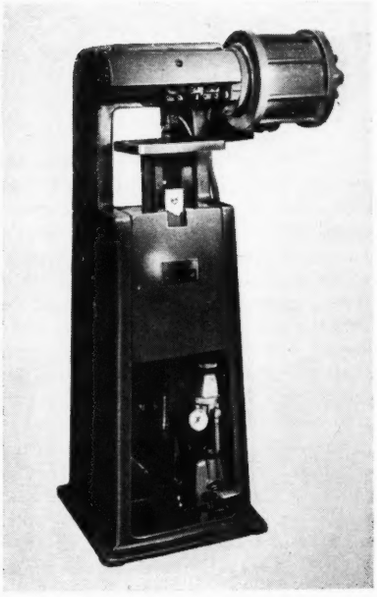
Clamps designed for holding work on tables of large type planers. These clamps, said to have many times the holding power of ordinary clamping arrangements, will be shown at the exposition by the J & S Tool Co., Inc., 477 Main St., East Orange, N. J. Loading and unloading are facilitated, as only one adjusting screw needs to be loosened to release the work. In operation the clamping jaw travels in and down at an angle of 45 degrees, forcing the work-piece horizontally against the opposite clamp, and downward against table. The result is a single powerful clamping action. The "Jumbo" size is 1 1/2 inches high by 2 1/2 inches wide by 6 1/2 inches long, while the "Lil-Giant" clamp is 1 1/4 inches high by 2 inches wide by 5 1/2 inches long. All are equipped with T-nuts designed to fit large standard planers and with varying types of nose-grips to meet special requirements. Booth 1922.

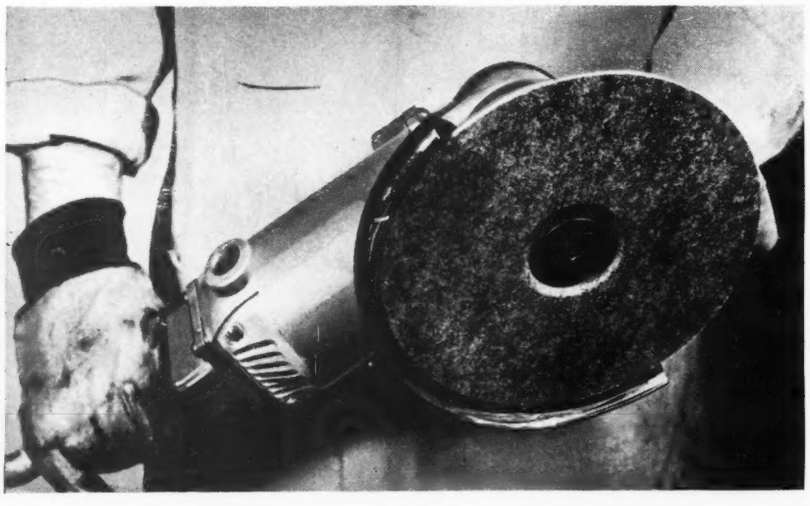




DoAll "Exmet" Dead Center

Dead center for lathes and grinding machines made of "Exmet," one of the new alloys developed to withstand the heavy wear and stress encountered in high-speed, high-temperature jet-engine operation. This center will be one of the new developments exhibited by the DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill. It is said to eliminate galling, burning, and the need for frequent lubrication. The new centers are availoble in all sizes of Morse, Brown & Sharpe, and Jarno tapers, both in conventional styles for lathes and in a gashed type for grinding or turning operations where extra clearance is needed. Booth 1634.





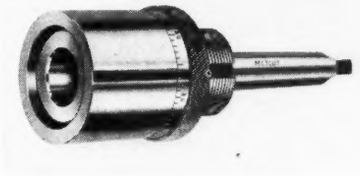
Matthews Reciprocating-Head Marking Machine

This reciprocating-head pneumatic marking machine is the newest addition to the Series 204 machines manufactured by Jas. H. Matthews & Co., 3924 Forbes St., Pittsburgh 13, Pa. It is especially designed to impress extra deep marks on tough metal surfaces without subjecting the parts being marked or the dies to excessive pressure or shock. The foot-pedal controlled reciprocating marking die is kept under a constant

air-cushion pressure, which is adjustable to any required pressure up to 6000 pounds. Normally only a fraction of a second is necessary for the reciprocating die to make the number of strokes required to produce an impression of the specified depth. Marking can also be done with a single stroke of the marking head when desired by setting a switch. Provision is made for holding both flat and round parts. Booth 1318.

New Products to be Exhibited by Metal Cutting Tools, Inc.

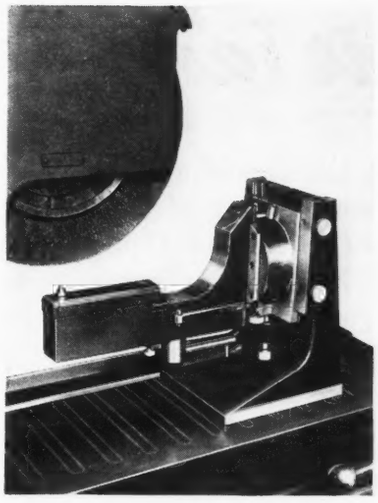
Metal Cutting Tools, Inc., Rockford, Ill., will exhibit the complete line of "Metcut" standard and special end-cutting tools, including counterbores, countersinks, back spot-facing cutters, core drills, and special combination cutters. A new design stop-collar and stop-nut holder will be shown for the first time. The principal features of this holder are



shown in the top view above. The depth of cut is regulated by the adjustable collar or nut. A new set of standard pin-drive counterbores like the one shown in the lower view will also be introduced at the show. Booth 200.

"Fluidmotion" Wheel-Dresser

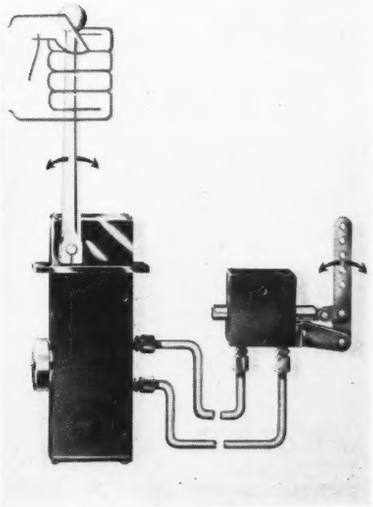
New model wheel-dresser designed to dress any wheel, from the smallest size up to 36 inches in diameter, and to maintain an accuracy of 0.0001 inch on sizes up to 14 inches in diameter, and 0.0005 inch on sizes up to 36 inches in diameter. This new "Fluidmotion" dresser will be exhibited by



the J & S Tool Co., Inc., 477 Main St., East Orange, N. J. It can be adapted to cylindrical, tool, and cutter grinders, as well as internal grinders. With this dresser, two angular surfaces which are tangent to a radius can be dressed in one continuous motion. The dressers are made of high-carbon, high-chromium, hardened, ground, and lapped alloy steels, and swivel on stainless-steel ball bearings. Booth 1922.

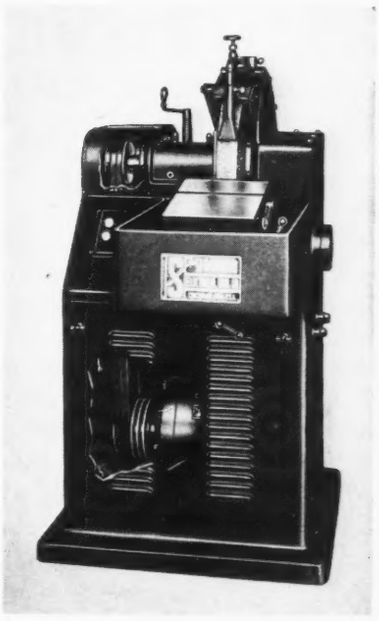
Superdraulic Remote Control

New hydraulic remote control of simplified design for positioning, controlling, and duplicating movements at a distance will be exhibited by the Superdraulic Corporation, 14256 Wyoming St., Detroit 4, Mich. This control is said to have many applications in the machine tool field. One of its important features is automatic compensation for contraction and expansion of the operating fluid. The company will also display its high-pressure pump, which is capable of developing 60 H.P. at a pressure of 5000 pounds per square inch. Booth 849.



Wet Tool-Grinder

Straight-wheel wet tool-grinder manufactured by the Standard Electrical Tool Co., 2500 River Road, Cincinnati 4, Ohio, which has recently been redesigned and is now available in 14-, 16-, 18-, and 20 inch sizes. The heavy spindle assembly and tilting table are designed to facilitate the precision grinding of metal-cutting tools. The grinder is also adapted for hogging or snag grinding of carbide tool shanks. The 10- by 20-inch graduated tilting table has renewable reversible table-top wear plates. An ample coolant supply is delivered to the wheel and work through the adjustable nozzle. Ball bearings are fully protected in a large size oil reservoir, which has a visual oil gage. Plate steel wheel flanges with



structural plate steel guards provide maximum safety. "Start-Stop" push-button station is provided, convenient to operator's working position. Quick-acting latches on spindle and base cover permit easy access to operating parts. Booth 1727.

"Press-Rite" Open-Back Inclinable Press

A new "Press-Rite" 60-ton, open-back, inclinable power press, featuring a one-piece, heavy-duty, special-alloy frame with built-in tie-rods, will be exhibited by the Sales Service Machine Tool Co., 2363 University Ave., St. Paul 4, Minn. The tie-rods are of high tensile strength steel and provide extra heavy reinforcement for the gap of the press so that deflection on heavy work is eliminated. Larger die space with added strength is also provided. The design of the one-piece tie-rod frame also reduces binding or misaligning of dies on extra heavy operations. Booth 1621.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Testimony Required for Workmen's Compensation

A. B. W.—A few months ago I was injured while doing my work. The Industrial Commission refused to allow me any compensation because I had only one doctor to testify that I was injured while doing my work. Can you help me?

Answered by Leo T. Parker, Attorney at Law
Cincinnati, Ohio

According to a recent higher court decision, compensation will be awarded under the State Workmen's Compensation Act based on the testimony of a single physician. In Standard Co. vs. Shepherd [185 Pac. (2d) 196], the testimony showed that an employe filed a claim for compensation under the State Workmen's Compensation Act. The claim stated that he sustained an accidental injury arising out of, and in the course of, his employment, and the testimony showed that the employe was taken to a physician immediately after the injury. The doctor testified that the employe sustained the alleged injury, and the Commission awarded compensation based on permanent partial disability.

Cracks in Electroplating

C. W.—We have had trouble with cracks and checks forming on the surface of zinc-base die-castings which are plated with brass, bright nickel, and gold, and then lacquered and baked at 285 degrees F. for thirty minutes. Can you suggest a cure for this trouble?

Answered by Editor, "Nickel Topics," Published by International Nickel Co., Inc., New York City

Without having an opportunity to examine the parts, it is impossible to diagnose the cause of your trouble. However, blistering and cracking can be due to any of the following things:

1. There may be a cold shut in the surface of the castings, or some other surface defect.

2. A porous surface may be produced by polishing off the dense skin, which has occluded either cleaning or pickling chemicals.

3. The cleaning cycle may be so severe as to produce etching of the zinc surface, which tends to trap cleaners and acids under the plate.

4. When plated die-castings are subjected to elevated temperature, the rate of diffusion between the first layer of copper or brass and the underlying zinc metal is accelerated, and a brittle alloy results which can be conducive to cracking and checking.

5. In a bright nickel solution, organic or inorganic contamination can produce excessive brittleness and stress, which may result in cracking and checking of the plate.

The above mentioned sources of trouble can be eliminated by (1) close examination of the die-castings to assure a good homogeneous surface; (2) control of the polishing operation to prevent removal of the dense material normally produced on the surface of the die-castings; (3) incorporation of an improved cycle for cleaning and preparing zinc-base die-castings for plating; (4) use of at least 0.0002 inch of copper or brass to prevent alloying completely through the initial deposit; and (5) electrolytic purification and activated carbon treatment to remove inorganic and organic contamination.

Molds Made of a Combination of Powdered Metals and Plastics

N. M. H.—I understand that, in molding some parts, it is sometimes advantageous to combine powdered metals and plastics. Under what circumstances is this true?

A.—One application of such a combination is in the production of certain types of electrical apparatus. In this case, cores are made of iron powder mixed with a binder of phenolic, polystyrene, or urea plastics. These are cold-pressed to shape and then baked for strength. Combinations of these materials give the cores unique electrical properties at radio frequencies, and permit the development of smaller coils with less copper.

* * *

To produce twenty-seven pounds of nickel, 2000 pounds of ore must be mined and processed.

INGENIOUS *Mechanisms*

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Converting Oscillating Circular Motion into Variable Reciprocating Movement

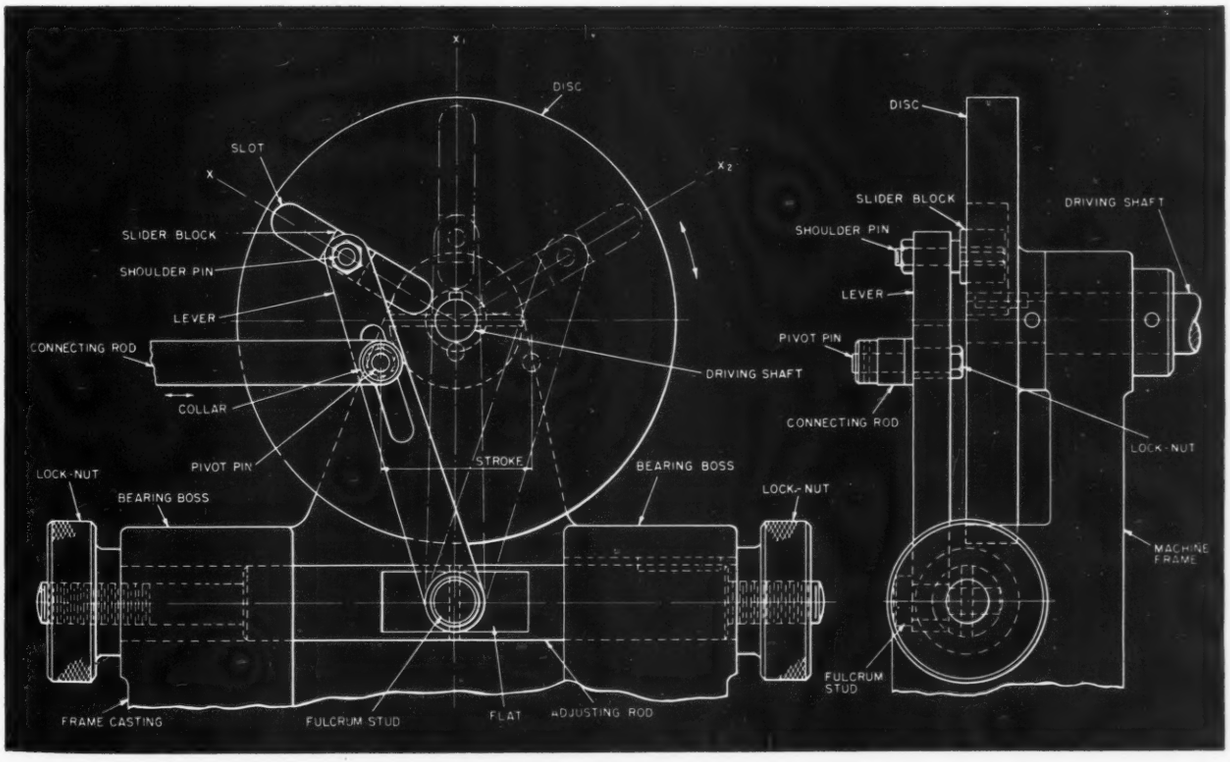
By W. M. HALLIDAY

An unusual lever mechanism designed to transform a uniform circular oscillating motion into a periodically varying reciprocating movement is illustrated below. This simple and inexpensive mechanism was devised to drive the former slide on a special wire-forming machine. The slide had to be reciprocated with a gradually accelerating rate of speed (faster than that of the driving shaft) for a portion of its stroke and an equally decelerating rate of speed for the remaining portion of its stroke. Means also had to be provided for increasing or diminishing the duration of these accelerations and decelerations and for altering the length of stroke without stopping the operation of the mechanism or machine.

The driving shaft is carried in a bearing that is an integral part of the machine frame. Keyed and pinned to the end of this shaft is a cast-iron disc. The opposite end of the shaft (not shown) is connected to a short link arm which is actuated by a fixed-throw eccentric, so as to impart a uniform, oscillatory circular motion to the shaft and disc. With this set-up, the shaft and disc oscillate through 120 degrees.

An elongated radial slot is machined in the front face of the disc. The length of the slot is determined by the length of stroke required for the driven slide and the permissible outside diameter of the disc. A phosphor-bronze slider block, fitted into this slot, is secured to the end of a lever by means of a threaded shoulder-pin and lock-nut.

The lever is linked to a connecting-rod by means of a pivot pin, located in a slot machined in the center of the lever. A collar pinned to the projecting end of the pivot pin retains the con-



Mechanism designed to drive a former slide on a special wire-forming machine

necting-rod, but allows it to swivel about the pin. The pivot pin may be adjusted to any desired position along the slot, and is locked in place by a nut at the rear of the lever.

The opposite end of the connecting-rod is attached directly to the driven slide (not shown), which has to reciprocate within horizontal guides in another portion of the machine frame. The lower end of the lever is mounted on a stationary fulcrum stud that is fixed to the side of a cylindrical adjusting rod. This horizontal rod is carried in two bearing bosses on the machine frame. The lever, thus mounted, can swivel freely upon the stud. A flat on one side of the adjusting rod provides a bearing surface for the location of the stud and the side of the lever.

Each end of the rod is reduced and threaded, and is provided with a knurled lock-nut which bears against the end face of the bearing boss. By adjusting the two lock-nuts, the rod can be moved horizontally to give any desired setting for the fulcrum stud. A key is provided within the right-hand bearing boss to prevent the rod from rotating.

As shown, the rod has been adjusted so as to bring the center of the fulcrum stud exactly in line with the vertical axis of the driving shaft and disc. With this setting, the lever will move an equal distance—60 degrees—each side of the vertical center line of the mechanism. The disc is shown about to commence its forward oscillation in a clockwise direction. This position of the elongated slot in the disc is denoted by X. Both the lever and the slide attached to the left-hand end of the connecting-rod thus occupy their extreme left-hand positions.

As the disc moves clockwise, the lever will be drawn to the right. However, since the lever is fulcrumed at a much greater radius than that of the shoulder-pin on the disc, the slider block will gradually move down the slot and approach the center of the disc. Throughout that portion of the stroke of the disc between positions X and X_1, the connecting-rod and the attached former slide will travel at an increasingly faster rate than the driving shaft.

When the lever has passed position X_1, however, the slider block will gradually move outward in the disc slot, and the driven slide will be correspondingly slowed down in speed. This deceleration will be at exactly the same rate as the acceleration occurring in the first portion of the stroke. When point X_2 has been reached, reversal occurs.

Throughout the return stroke from X_2 to X_1, the speed of the lever and the driven member will be increased, while their speed will be decreased when the lever passes from point X_1 to the original starting point X. Thus, for each complete oscillation of the disc and its driving shaft, the driven slide will receive two accelerations and two decelerations of equal duration.

The maximum stroke is obtainable by adjusting the pivot pin so that the connecting-rod is set at the highest point within the slot in the disc. By moving the pin to the opposite end of the slot, so that it lies at the shortest possible radius from the center of the fulcrum stud, the minimum stroke is obtained. Variations of stroke length ranging between these maximum and minimum values can be readily obtained by changing the position of the fulcrum stud relative to the vertical axis of the mechanism. Such changes can be effected while the mechanism is running merely by adjusting the lock-nuts and the lateral position of the adjusting rod in its bearings.

Unique Pumping Mechanism Applied to a Homogenizer

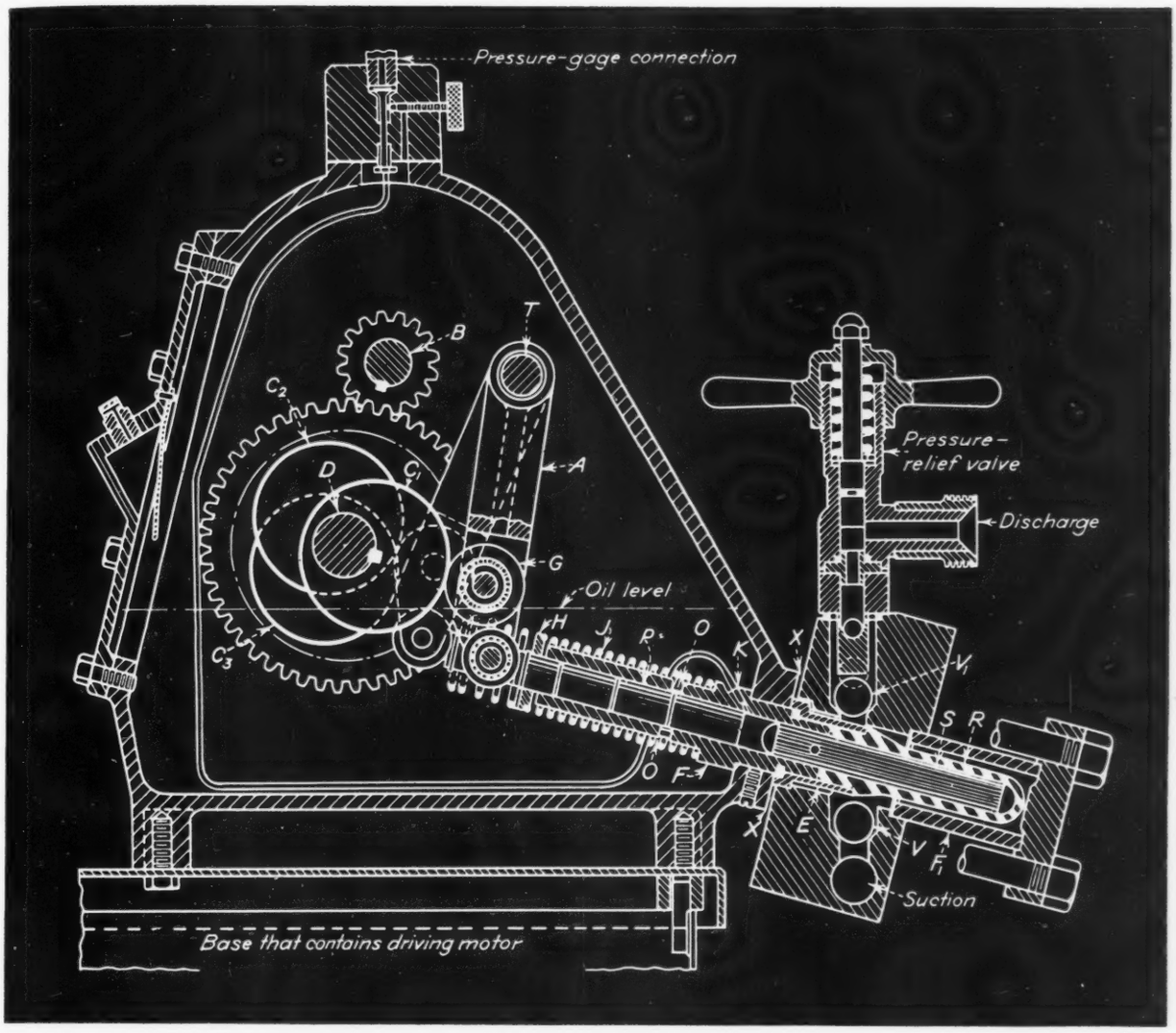
An ingenious mechanism designed to impart pulsations to three plungers has been incorporated in the Hydropulse homogenizer recently developed by the Pioneer Division of Scott & Williams, Inc., New York City. Hydraulic suction and pressure are alternately obtained in this equipment by pulsators R through the action of pistons P (see accompanying illustration).

The pumping portion of the mechanism, with ball suction and discharge valves and a pressure relief valve, is shown at the right-hand end of the drawing. The driving mechanism consists of a camshaft D, on which there are three cams C_1, C_2, and C_3, which actuate pistons P. There are three sets of pistons, plungers, etc., which extend in parallel position toward and through the pump housing.

Camshaft D is geared to drive-shaft B, which is rotated through multiple V-belts by a motor in the base of the unit. Pistons P, their cylinders, and part of their operating mechanism are constantly immersed in the actuating fluid, which is oil.

Each pulsator R is made of synthetic rubber and bonded to a sleeve E. A metal support S inside the pulsator is connected to cylinder F. Each piston is provided with a collar H that takes the pressure of spring J.

Rocker arm A pivots on shaft T. Each cam rides against a ball-bearing roller G which is mounted on a stub shaft in a corresponding arm A. A second ball-bearing roller on this arm con-



Triplex type of pumping mechanism which imparts three pulsations to a homogenizer with each revolution of a camshaft

tacts the left end of the piston. In the position shown in the illustration, cam C_1 has pushed piston P into the discharge position against the action of spring J. When the camshaft makes a half revolution, cam C_1 will have moved 180 degrees to permit piston P to move toward the left and uncover ports O, so as to compensate for any slight oil leakage from the cylinder and prepare for the discharge stroke.

Pressure inside the rubber pulsator is relieved at this time, and it contracts to create a vacuum inside cylinder F_1. Liquid then flows into this cylinder through the ball suction valve V. When cam C_1 makes another half revolution, arm A moves piston P into the position shown, and forces oil into the rubber pulsator. The pulsator then expands and forces liquid out of cylinder F_1, through the ball discharge valve V_1 and out through the discharge connection.

The pump, being of a triplex design, makes three pulsations for each revolution of the camshaft, which insures a fairly constant flow of oil. The discharge pressure is measured by a gage connected to the cylinder at K.

* * *

Proposed Standard on Pump Mounting Dimensions

A proposed standard on mounting dimensions of lubricating and coolant pumps for machine tools has been formulated by Technical Committee 26 of the American Standards Association. The Proposed American Standard ASA B5 has now been published by the American Society of Mechanical Engineers, one of its sponsors. Other sponsors are the Metal Cutting Tool Institute, Society of Automotive Engineers, and National Machine Tool Builders' Association. Copies of the tentative draft can be obtained by addressing D. M. Shackelford, American Society of Mechanical Engineers, 29 W. 39th St., New York 18.

THE SALES ENGINEER AND HIS PROBLEMS

By BERNARD LESTER
Lester and Silver
Sales Management Engineers
New York and Philadelphia

Exact Estimates or "Guesstimates"

IF we are sick, do we go to a druggist for diagnosis, or to a doctor to buy pills? No, we first see our doctor. He analyzes our case and writes out a prescription. Then we see the druggist and buy medicine. Both must be paid—one for service, and the other for drugs.

Sales engineers are both doctors and druggists. We supply engineering service and also equipment. Analyzing the problem and preparing a buying specification takes time and money, just the same as building the machinery we sell.

Most purchasers don't fully appreciate the cost of application engineering service. They get all they can without obligation. Too many have us prepare the specification and then go elsewhere and shop for equipment that we had engineered. They expect to get medical service free, and only pay the druggist.

Machinery is useless unless properly applied. Skill in application engineering needs years of preparation. We can't afford to spend our skill and time—and that of our associates—aimlessly. Every inquiry necessitating application engineering presents the possibility of expense or investment. Risks are involved. Hence, to obtain a good "batting average," we can't stress too strongly the necessity of carefully evaluating the extent of each risk and each investment.

Here is a case in point related by an experienced sales engineer: He was asked by a small prospect to figure on a large job running into six figures. The financial position of the company was poor. The prospect confided to the sales engineer that the company was to be sold to a large corporation, and to make an advantageous deal, a well worked out plan of expansion had to be supplied.

Since many hours of engineering time was needed to prepare an adequate proposal, the sales engineer called on the officials of the large corporation that was considering buying the smaller company. He found that even if they bought the small concern, they would never proceed with the project. Hence he diplomatically refused the bid. Within a few hours, his prospect appealed to the president of the sales engineer's company, and the latter called the sales engineer on the phone.

"Here's a big project," he said, "Get busy; looks like you're not on the job." After a full explanation, condemnation changed to praise for a wise choice in the use of engineering estimating time.

Technical help is a precious ingredient by which we convert inquiries into orders. But how many of us weigh carefully its risk and cost? Emerson, in his essay on "Compensation," said, over a century ago: "If your tax is too high, the revenue will yield nothing." How significantly this applies to sales engineers, as well as to our entire national economy!

These suggestions may help to allocate our technical estimating skill:

1. The prospect's financial credit should be checked before beginning work on a job. Credit depends both on ability and willingness to pay. Often buyers "pay slow," making us finance their project.

2. Is the project economically sound? Today plenty of prospects, lacking experience, ask for elaborate equipment proposals on the chance of their getting a large contract for work.

3. How about the prospect's ability to get both labor and materials? Many a "hopeful" calls for a bid and tells us "not to worry about that."

4. What are the prospect's motives and record in buying? A buyer often throws his arms around us, saying that we have the best chance for the job. We invest our time and skill. Then he takes our engineered proposals and specifica-

tion and gives Tom, Dick, and Harry a chance to under-bid us.

To meet these risks, keen judgment is required. "Guesstimates" may suffice rather than exact estimates. Is the project worth a well engineered job or simply an approximate estimate?

On the other hand, we can do a complete engineering job and receive an award without accurate specifications. One sales engineer told me he spent days working out a job, and received only a brief purchase order. Upon its receipt he wisely prepared a written specification that would permit no loopholes. He then had the customer's order revised to include it.

Let's examine carefully where best to invest time and skill. Conditions being right, and risks of waste effort low, let's give the best kind of technical service to the prospect.

Let's sell the idea that good technical service comes high, but is worth it; and that poor engineering services are as costly as weeds in a bean patch. The doctor must be paid, as well as the druggist.

Successful sales engineers know when, where, and how to give engineering service. Luckily there's no government directive limiting the use of our brains in the use of engineering service in selling.

New Book for Sales Engineers

SELLING TO INDUSTRY. By Bernard Lester. 255 pages, 4 1/2 by 6 7/8 inches. Published by THE INDUSTRIAL PRESS, 148 Lafayette St., New York 13, N. Y. Price, $3.50.

This is a compact, pocket-size book that has been written as a manual of practical ideas and suggestions for the sales engineer who wants to analyze and improve his methods of finding, contacting, selling, and servicing industrial customers. As the author points out in his introduction, "Selling any prospect effectively does not follow a beaten path. Prospects and salesmen vary in temperament, habits, and interests. Products sold differ, and new problems in their application and use continually crop up. But success in selling is not a haphazard affair. Proper preparation and orderly enthusiastic procedure are necessary."

In this manual, Mr. Lester has set forth, in a brief and realistic way, those key points that have been found, by experience, to be most effective. He writes from a wealth of experience as sales executive for the Westinghouse Electric Corporation, lecturer on sales engineering and marketing at the University of Pittsburgh, Stevens Institute, and Brooklyn Polytechnic Institute, and as a consultant on machinery and equipment marketing and selling.

The book is written in the form of short, easy-to-read articles, which are grouped in a series of sections entitled: "Prospects are Our Market"; "Just How Do Prospects Buy?"; "Sales Program Essentials"; "Make the Sales Program Effective"; "Successful Sales Interviews"; "Sell the Prospect's Employes"; "Be a Better Equipment Salesman"; "Getting Help from Others"; "Use All Our Sales Tools"; "Meet the Prospect's Objections"; "Follow up the Customer's Decision"; "Grow in Power and Sales Skill"; and "When Orders Hang on Trees." Most of these articles have appeared in MACHINERY in a somewhat briefer form, and reprints of many have been used effectively by several industrial concerns in the metal-working field.

At a time when industrial equipment and machinery are in heavy demand, with large backlogs of orders building up in many cases, it would seem as though the need for sales guidance and training were not very great. Mr. Lester, however, presents sound and convincing reasons for continued, planned sales and service effort, regardless of present-day market prospects.

This book is well suited for adoption by industrial concerns as a training manual for their sales engineers.

* * *

Exchange Plan to Free Idle Steel

A plan to get stagnant steel and idle metal-working equipment into use, or moved to the steel mills as scrap, has been announced by Joseph T. Ryerson & Son, Inc. The program provides for an exchange between steel users, making usable steel and equipment that may be lying dormant available to someone else who can use it. To do this, Ryerson is urging all its customers to make an inventory of their steel not in use, as well as discarded machinery; then the company will publish classified advertisements, without charge, in its pictorial type newspaper, which is circulated to more than 100,000 firms, in order to help its customers sell the steel and equipment they do not need.

The campaign is expected to help relieve the pressure for new steel and aid in maintaining the high rate of steel production necessary to the defense program.

LATEST DEVELOPMENTS IN *Shop*

LeBlond Automatic Lathe for Profile-

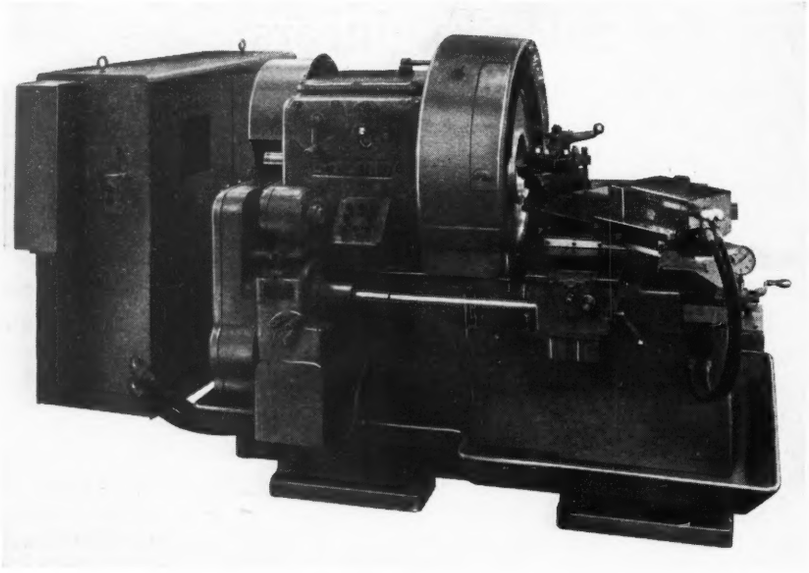


Fig. 1. Front view of new automatic lathe for profile-facing jet-engine compressor discs, brought out by the R. K. LeBlond Machine Tool Co.

The new contour facing lathe now in production by the R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio, is designed for the specific purpose of profile-facing jet-engine compressor discs by a completely automatic cycle. It performs this work by the use of an extremely simple profiling attachment in a unique manner.

The automatic cycle can be used for machining disc profiles that are completely finished by a facing cut taken only to the center of the disc, and it can also be used to face the profiles of discs that require an interrupted cut across the entire face, as in the case illustrated diagrammatically in Fig. 3.

A hand-adjustment with graduated dial reading to 0.001 inch is provided to control the depth of the facing cut. The carriage, in the form of a simple bridge across the abbreviated bed, carries a

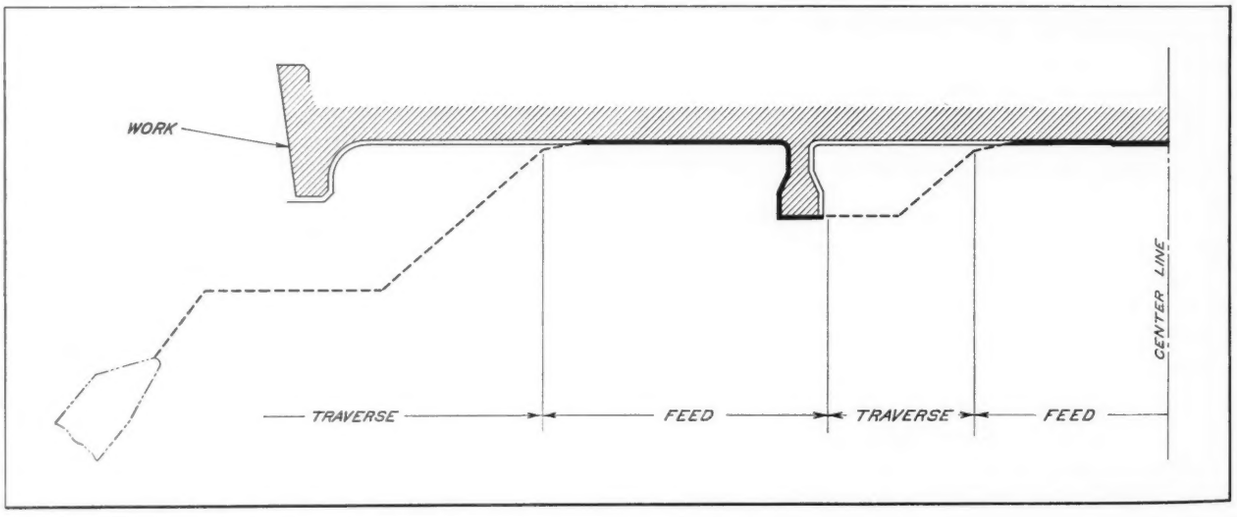


Fig. 3. Diagram illustrating "across center" method of profile-facing jet-engine compressor lines, is obtained by a combination of the movement of the tracer slide and the rapid traverse When tool reaches center of work, the direction of work rotation is automatically reversed,

Equipment

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on Market

Edited by FREEMAN C. DUSTON

Facing Jet-Engine Compressor Discs

cross-slide on which various types of tool-slides can be mounted.

Initial variations in the basic design of this machine make it adaptable for facing the wide variety of discs required for different jet engines. Two headstocks are available—one a high-speed head for profile-facing aluminum discs used at the "cold end" of the engine, and the other a lower speed head for facing stainless steel and titanium discs. The machines may be of reversing or non-reversing type, and can be equipped with either manual or automatic controls as required.

On the fully automatic machines, the LeBlond "Hydra-Trace," mounted on the cross-slide, is an integral part of the design. The "Hydra-Trace" is a simple, single-directional tracer having a stylus that follows the contours of a flat template and hy-

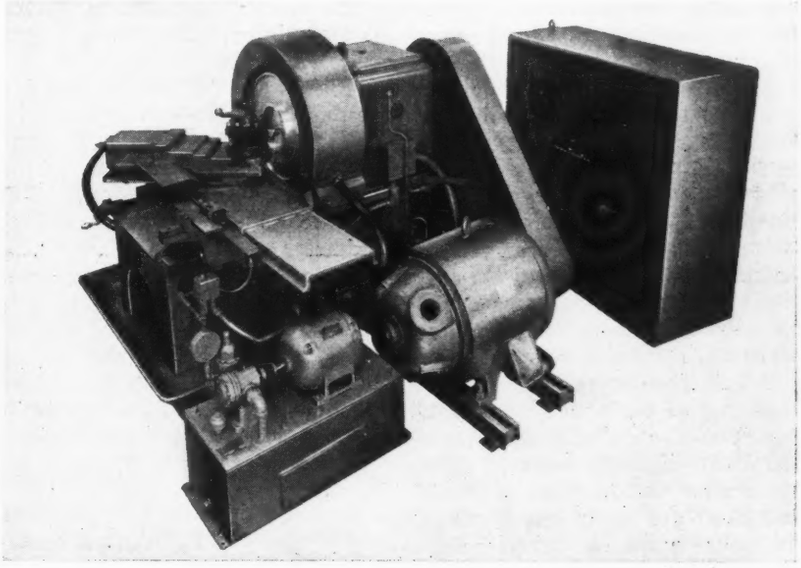
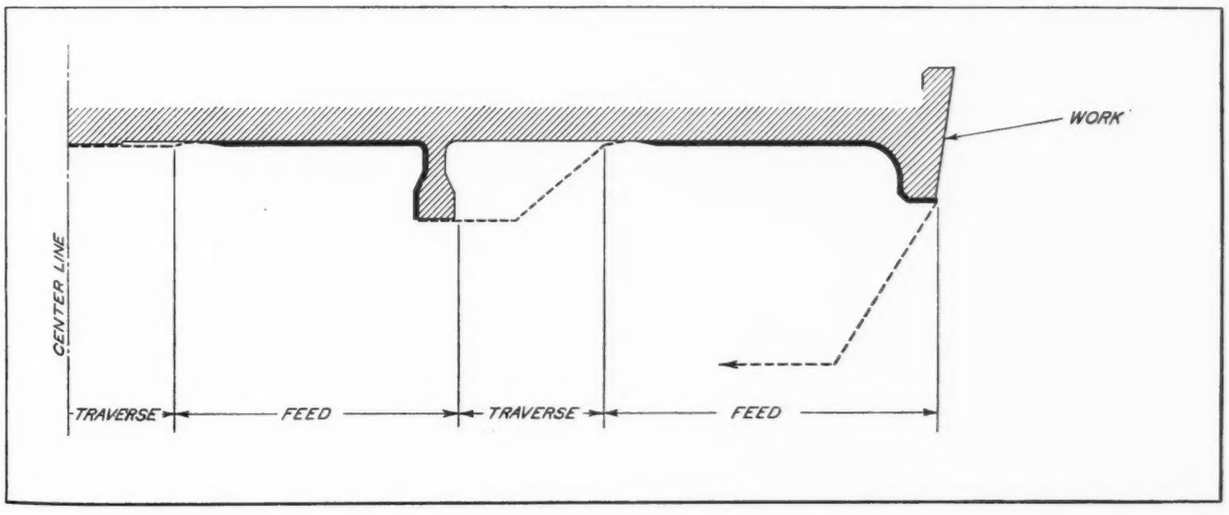


Fig. 2. Another view of the LeBlond lathe illustrated in Fig. 1, developed to solve difficult machining problems on jet-engine parts



disc with full automatic cycle set-up. The angular approach of the tool, indicated by dotted movement of the cross-slide. Heavy black lines indicate metal removed by profile-facing cut. but the tool continues to feed in the same direction until profile-facing of disc is completed

draulically controls the path of the tool. The angle of the tracer slide is adjustable to meet various conditions encountered in the profiling operations. Should pressure in the hydraulic system drop below 100 pounds per square inch, a safety valve would function automatically to bring the entire machine to a stop.

When the operating angle of the top slide and limitations of the tool make it impossible to complete the required profile in one pass, from the periphery of the work to its center, in the conventional manner, the "across center" method is used, by means of which the outer or external shoulders are machined when feeding from front to center, as indicated in the part of Fig. 3 shown on the left-hand page. Inside or internal shoulders are then machined when feeding from the center to the rear of the work, as indicated in the part of Fig. 3 on the right-hand page. In this case, the spindle is reversed when the tool reaches the center, but the cross-slide is made to continue its feed in the same direction by reversing the feed drive when the spindle is reversed.

All of these operations, in addition to tool retraction and rapid traverse, are accomplished automatically. Spindle reverse, forward and reverse rapid traverse, and feed are controlled by limit switches actuated by trip-dogs conveniently located to facilitate setting up and adjusting the cycle timing.

After the work has been loaded into the machine, the operator is required only to engage the tracer control lever and push the automatic cycle starting button. The angular approach to the work is obtained by a combination movement of the tracer slide and the rapid traverse of the cross-slide. As the tool nears the work, the rapid traverse is converted to a constant feed, and the "Hydra-Trace" controls the path of the tool to the end of the cut.

The feed and rapid traverse dogs may be set to produce any cycle required by the shape of the work. On pieces for which the "across center" operation is employed, the spindle direction is also automatically controlled by a limit switch actuated by one of the dogs. At the end of the cut, both the tracer slide and the cross-slide are automatically returned to their starting position by rapid traverse.

The spindle speed is varied by means of a flat cam-actuated reactor, which controls the variable-speed unit in such a way that a constant cutting speed is maintained throughout the cycle. The cam can be modified or replaced to suit the required conditions. The extent of spindle-speed variation is dependent upon the job, and determines the electrical equipment furnished. In addition to the speed variation provided by the motor, three ranges are available through lever-shifted gears, and additional ranges through pick-off gears. Full coolant equipment includes pan, tanks, filters, pump, piping, and complete electrical controls.

Figs. 1 and 2 show a typical jet-engine aluminum compressor disc being profile-faced on a LeBlond No. 1 automatic contour facing lathe with reversing cycle. The tool begins its cut on a 16-inch diameter at 208 R.P.M., or at a speed of 870 surface feet per minute. This surface speed is maintained by variable speed control until a maximum of 550 R.P.M. has been reached at the 6-inch diameter. The spindle speed is then kept constant across the center until the tool is 3 inches beyond the center, at which point deceleration is begun. At the end of the cut, the tool is cutting on a 23-inch diameter, and the spindle speed has been reduced to 145 R.P.M. When using a feed of 0.012 inch, the cycle time, exclusive of loading, is 4 minutes 50 seconds.

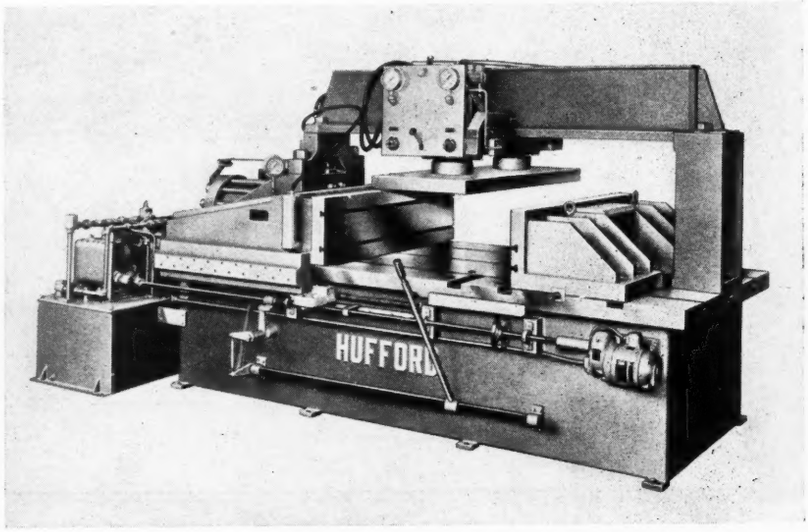
These new automatic contour facing lathes are designed mainly for finish profile-facing in high-production set-ups. Where discs and wheels do not require the "across center" technique, the non-reversing machine is especially economical. Although this machine also operates automatically, it needs no spindle and feed reverse, and is therefore considerably lower in cost.

The contour of some discs is such that the single slide tracer described is not applicable. For such cases, a two-directional tracer which controls the feed hydraulically in both directions is available. The variable-speed drive, the automatic cycle, and other features of the machine are unchanged in these cases.

In addition to the set-ups previously described, the machine can be furnished with a power angular feed compound rest instead of the "Hydra-Trace," in which case manual controls are furnished in place of the automatic cycle.

Hufford Metal-Forming Bulldozer

When bulldozers are used for metal-forming, the dies must often be provided with top pressure plates to retain the metal within the die during the forming operation. The pressure plates are usually bolted to the top of the die and must be loosened to



Hufford metal-forming bulldozer equipped with die pressure-plate clamping cylinders

permit removal or repositioning of the work. In order to overcome this loss of time and to speed output, the Hufford Machine Works, Inc., 1700 E. Grand Ave., El Segundo, Calif., has brought out a press with vertical hold-down cylinders, which replace the bolts and positively secure the pressure plate on the die. The cylinders are instantly released upon completion of the operation, allowing fast removal and reloading of the work.

The two 25-ton hold-down cylinders are mounted on a rolling assembly, which can be positioned anywhere along the bulldozer bed. Each cylinder is independently controlled by a four-way selector valve. Pressure can also be varied by means of reducing valves. These controls are integral with the overhead assembly, and are mounted on a panel.

For regular bulldozing when vertical die pressure cylinders are not required, the vertical space is increased simply by unbolting and removing the overhead track and clamping unit. Sensitive control is provided by a threaded lead-screw type shipper-rod, which extends along the side of the bed. This rod is rotated by a reversible motor drive. A stop, threaded on this screw, can be rapidly shifted back and forth by means of electrical push-button controls. This stop is engaged by the traveling ram, which shifts the shipper-rod laterally and gradually reduces the oil flow from the variable-volume pump. When zero volume is attained, the ram automatically halts. Pin-point repetitive accuracy is said to be assured by this equipment.

Also attached to the shipper-rod is a handwheel for making very fine adjustments. One rotation of the handwheel equals 0.125 inch of ram travel. The hand-lever at the front of the machine controls the rate of ram travel, as well as starting and stopping.

The Model 88 bulldozer illustrated is rated at 150 tons, but presses of other capacities are available. Adjustable platens provide 24 to 60 inches of daylight capacity. The platen is 16 by 60 inches. The overhead clamping unit provides from 8 to 18 inches of daylight capacity, and the platen is 24 by 60 inches. Pressing speed of the main ram is variable from 0 to 70 inches per minute, and the retracting speed from 0 to 90 inches per minute. The ram stroke is 24 inches.

Reed Welding Positioners

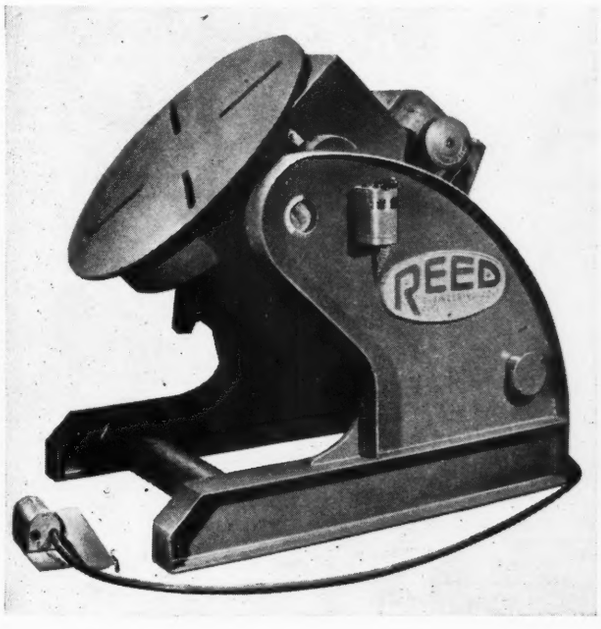
A new line of medium-duty welding positioners recently announced by the Reed Engineering Co., 1003 W. Fairview Ave., Carthage, Mo., is now available in two standard sizes. The Model P-10R has a capacity of 1000 pounds, and the Model P-25R a capacity of 2500 pounds.

The new design features a compact, three-in-one table tilting frame, designed to reduce to a minimum backlash and lost motion in the table rotating mechanism. Speed of rotation can be varied through a 10 to 1 speed range by means of a handwheel adjustment. The tables of both models can be tilted by hand or power through a 135-degree angle, tilt indicators being provided to facilitate adjusting the tables to the required angle.

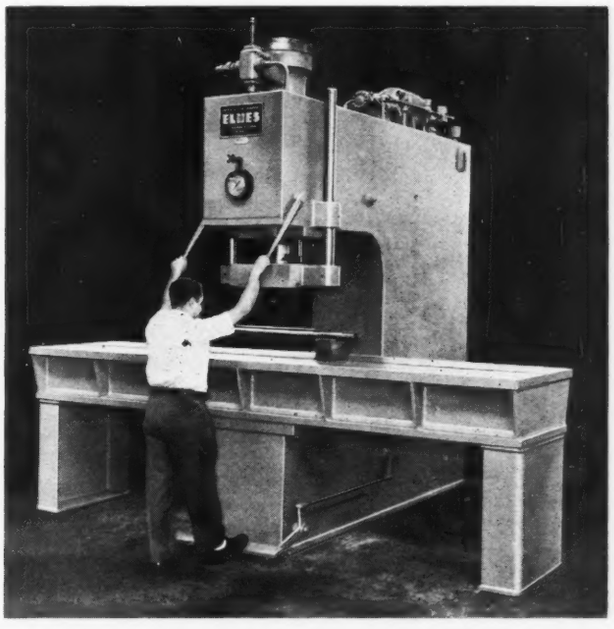
Elmes Dual-Purpose Hydraulic Press

A dual-purpose C-frame hydraulic press designed to combine straightening and forcing operations was recently built by the Elmes Engineering Division, American Steel Foundries, 1162 Tennessee Ave., Cincinnati, Ohio, for installation in a large ordnance plant. The press has a capacity of 75 tons, and is especially equipped for double-duty operation.

A long table is provided for use in straightening gun barrels. This table can be removed when the press is to be used for general-purpose straightening. An opening in the bed provides for performing forcing operations. The dual hand-lever is interlocked with the foot-treadle, so that the ram will not descend until both of the hand-levers and the foot-treadle are depressed.



Medium-duty welding positioner brought out by the Reed Engineering Co.



Elmes dual-purpose C-frame hydraulic straightening and forcing press

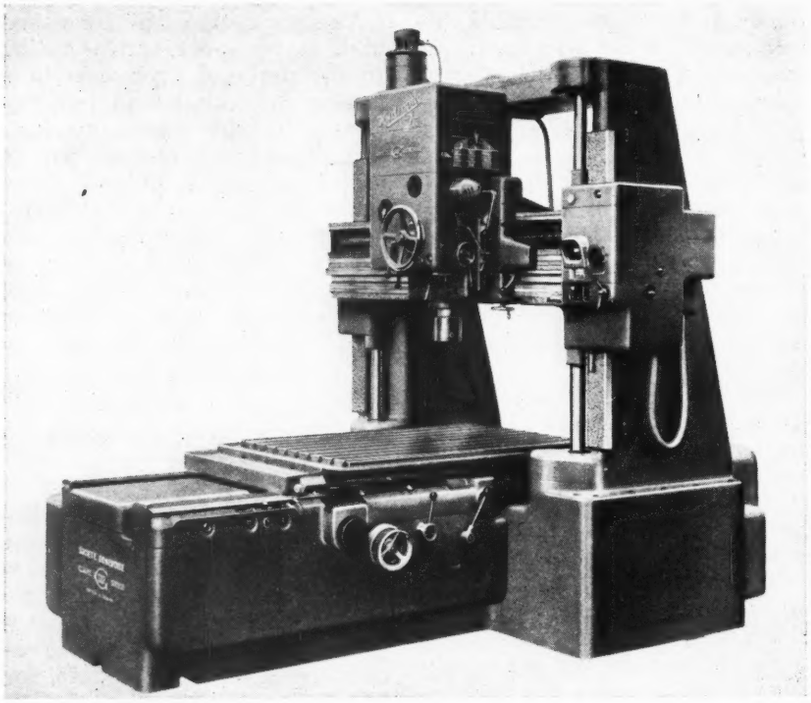
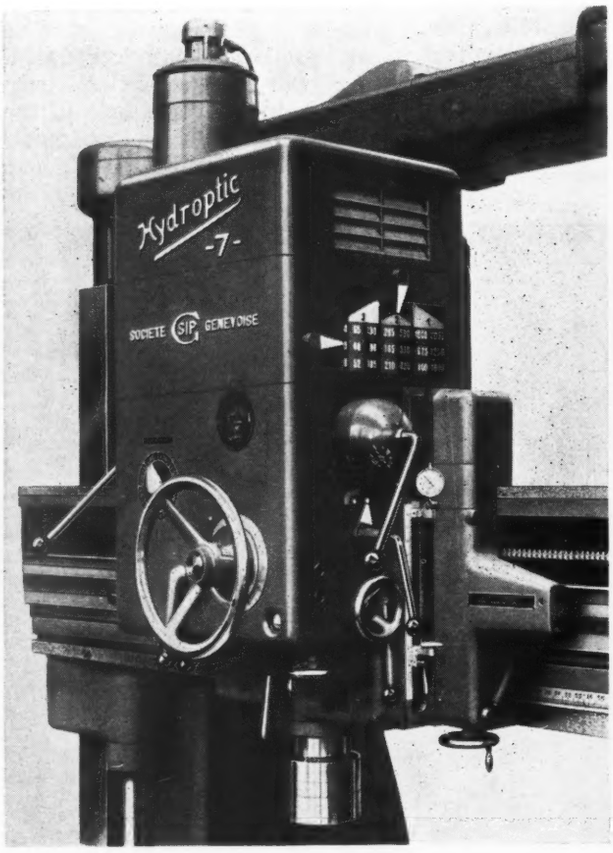


Fig. 1. Sip jig boring and milling machine equipped with screens on which optically projected magnified scales can be easily read

Sip Jig Boring and Milling Machines with Screens for Viewing Magnified Scales

The large "Hydroptic" 7P and 8P optically set Sip jig boring and milling machines introduced in this country by the American Sip Corporation, 100 E. 42nd St., New York 17, N. Y., are now furnished with viewing screens, on which the graduation lines of the built-in standard scales are optically projected with a large magnification. This system, used in place of the former microscope eyepiece, is said to lessen eye-strain and speed up machine setting operations.

The screens are built into the bed and the cross-rail, and also into the horizontal head in the case of the "Hydroptic" 8P machine. The rectangular surfaces of the screens are illuminated by green light. In the field is a movable reticule in the form of a pair of pointers or "beaks," the position of which is controlled by the micrometer drum located close by, which has 0.0001-inch graduations. With this arrangement, accurate settings can be made in a few seconds by simply centering the projected line between the reticule beaks, using the fine-positioning handwheels. Rough settings are made by external scales.



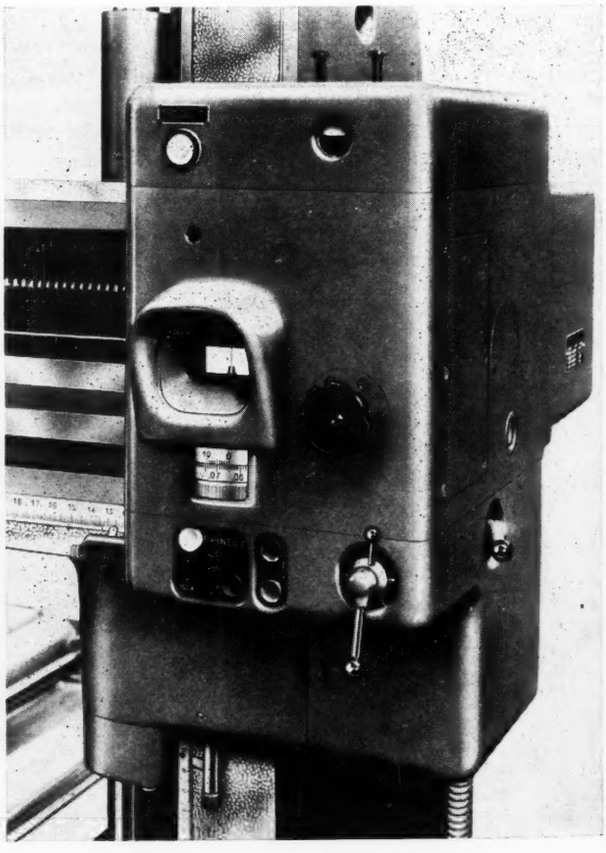


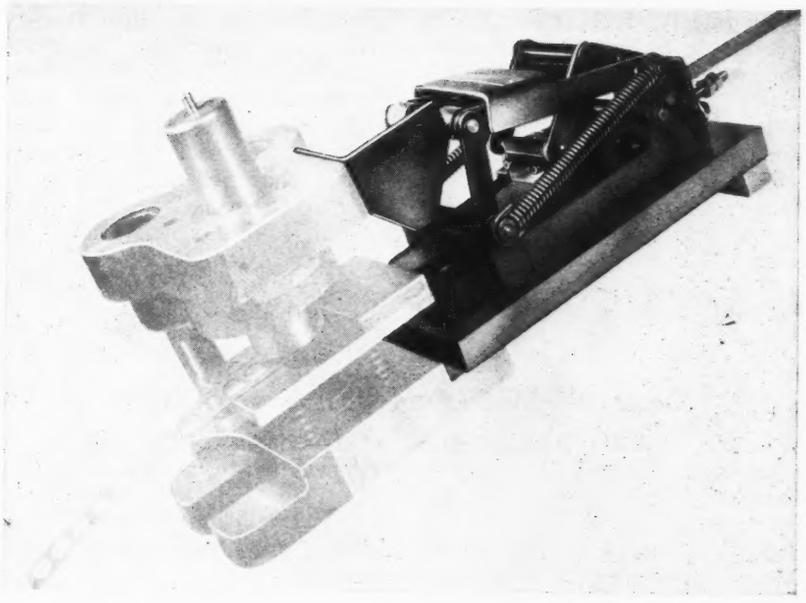
Fig. 2. (Left) Close-up view of spindle head of machine shown in Fig. 1, with viewing screen conveniently positioned on right-hand side of head. Fig. 3. (Right) Close-up view of viewing screen on cross-rail

Jaco "Grip-O-Matic" Press Feed for Coiled Stock

A low-cost automatic hitch type press feed, designed for mounting on a die set or bolster plate, is announced by Jaco Devices, Inc., 97 High St., Hingham, Mass. This "Grip-O-Matic" feed is cam-operated, but it does not rely on the cam to obtain or maintain accuracy of the feeding movement. It grips the stock firmly under spring pressure while the stock is being fed into the press tool, but at a predetermined point—before the die starts to work the material—the gripper releases, and the stock is free to float in response to die pilots or metal flow requirements of forming operations.

Slippage due to stock inertia is controlled, and consequently pitch accuracy can be maintained. On the return stroke, the gripper remains open, thus insuring minimum wear on the gripper blade and freedom from scratches on polished stock.

The "Grip-O-Matic" feed will operate from any side of the die set to which the cam is attached, and will feed the stock on either the up or down stroke of the punch press ram. A ratio of 2 to 1 exists between the distance the stock travels and the lateral movement of the cam roller; consequently, a feed length of 2 inches can be obtained on a punch press having a stroke of only 1 inch. The tool will feed coiled stock of any thickness up to 3/32 inch by 2 inches wide, at any pitch or feed length up to a maximum of 2 1/2 inches.



"Grip-O-Matic" press feed announced by Jaco Devices, Inc.

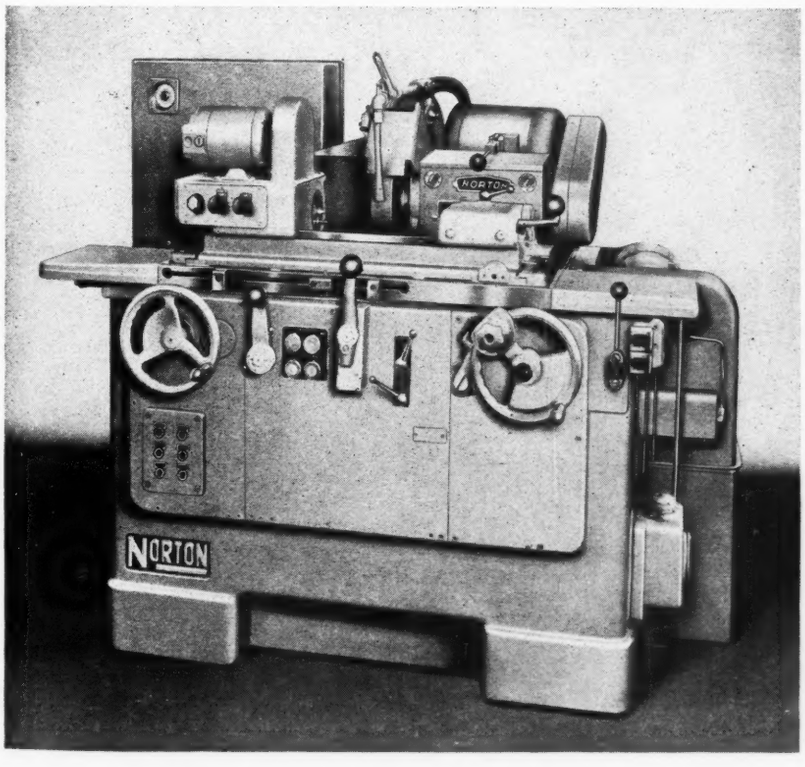
Norton Cylindrical Grinding Machine

A 4-inch Type CTU cylindrical grinding machine, designed for fast, accurate grinding of small cylindrical parts, has been developed by the Norton Co., Worcester 6, Mass. This entirely new machine is available in both plain and semi-automatic types, with work length capacities of either 12 or 18 inches. It is designed to provide exceptional operating ease, as well as rapid, precise grinding action.

The feed-handwheel graduations indicate the amount of feed as the handwheel is rotated past a fixed pointer. A "click-count" indexing mechanism on the handwheel facilitates making fine-feed settings by "feel." This mechanism causes a detent to click upon the rotation of its control knob, each "click" representing the setting for a reduction in work diameter of 0.0001 inch.

Grinding and truing table speeds are independently adjustable, and are quickly obtained by positioning the table start-stop lever. No resetting of speeds is necessary when changing from one to another. Extremely smooth and slow table speeds for truing the grinding wheel are assured by well lubricated baseways and complete guarding of the ways by fixed table extension guards.

Automatic or manual control of



Cylindrical grinding machine of completely new design introduced by the Norton Co.

work rotation and coolant flow is obtainable by means of a selector switch. Automatic adjustable wheel feed at table reversals, with automatic reset of the wheel-head, and separate dwell controls for each end of the table travel are also features developed to permit traverse grinding with a minimum of effort.

The semi-automatic machine has all the advantages of the plain machine, and, in addition, provides an automatic, adjustable grinding cycle, which is controlled by the movement of a single lever. This simplified form of control permits the operator to devote a major share of his attention to loading the machine. The wheel-spindle unit has long, full, pressure-lubricated bearings which enclose over 50 per cent of the wheel-spindle body.

New "Red Ring" Helical Gear Grinder

A new "Red Ring" helical gear grinder, designated Model SGF, has been brought out by the National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich. This machine is designed primarily for the high-precision form-grinding of helical gears, but it can also be used for spur gears and splines.

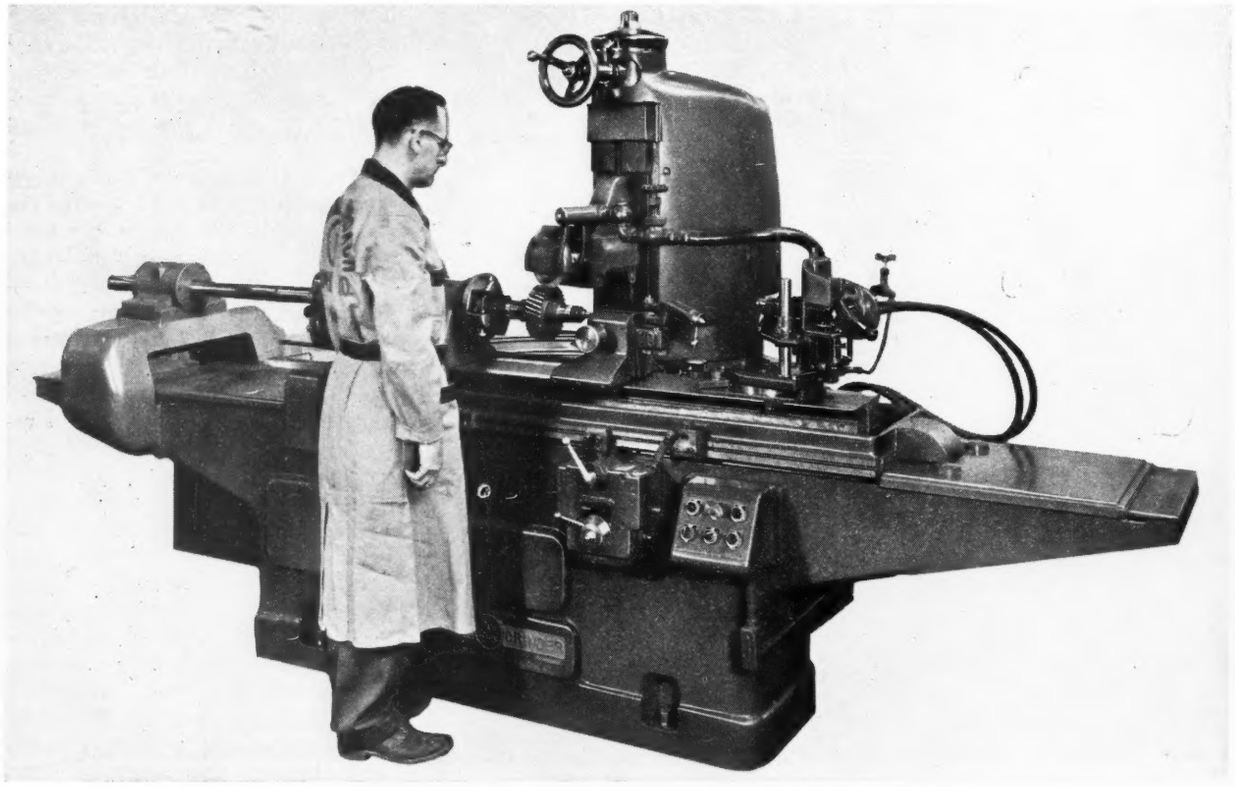
An improved lead-bar arrangement is incorporated to insure maintaining the true helix angle of helical gears. This consists essentially of an accurately ground master lead-bar, operating through a pressure-lubricated self-tightening anti-backlash saddle nut, with the work-drive headstock coupled through the index-plate to one end of the bar. As the lead-bar is reciprocated the work rotates with it. Thus, the lead of the work being ground is identical with that of the direct-coupled master lead-bar.

The split saddle nut through which the lead-bar reciprocates is rigidly supported by a bridge housing, bolted to the machine base. The column of the helical grinder is mounted on the machine base, and can be easily located to position the wheel for the desired helix angle of the work.

The automatic index mechanism is an integral part of the precision live-center headstock, mounted at the left end of the table. Indexing is entirely mechanical, being actuated by the motion of the lead-bar. For grinding spur gears, the lead-bar can be easily disconnected and indexing done manually. The indexing control includes a large-diameter index-plate, ground to a tooth-to-tooth tolerance of 0.0001 inch and an accumulative tolerance of 0.0005 inch. When this plate makes a complete revolution, the work-table automatically stops.

The housing carrying the grinding-wheel spindle is moved vertically by an elevating screw operated by a handwheel. A slip drum with 0.0005-inch graduations facilitates accurate vertical setting of the head.

The grinder is equipped with precision wheel-dressers for any tooth form desired. These include dressers for the involute, root diameter, full root radius, angle, and root fillet. The dresser head carries two horizontal and parallel spindles, each free to rotate on its own axis and each pivoted on a rocker-shaft beneath it, thus giving them two rotary motions. Each spindle carries at one end a diamond-tipped dressing tool, and at the other a corresponding follower point. The follower points bear on the sides of a hard accurately ground master tooth form.



"Red Ring" helical gear grinding machine recently brought out by the National Broach & Machine Co.

In operation, the follower points trace along the contour of the master tooth form, causing the diamond points at the opposite ends of the spindles to move in similar paths in contact with the grinding wheel.

Pittler Turret Lathe

The Cosa Corporation, 405 Lexington Ave., New York 17, N. Y., is introducing in this country the new line of Pittler turret lathes, which includes models known as "Pirex 32" and "Pirex 50." The "Pirex 50" lathe, shown in the accompanying illustration, will take bar work up to 1.9 inches in diameter, and will chuck work up to 6.7 to 9.8 inches in diameter. It has a spindle nose with flange diameter of 8.3 inches.

The maximum diameter swing over the bed is 15.7 inches. The maximum distance between spindle flange and turret face is 25.6 inches. There are eleven forward and reverse spindle speeds ranging from 18 to 1800 R.P.M. Longitudinal and transverse feeds of turret-slide are 0.001 to 1 inch.

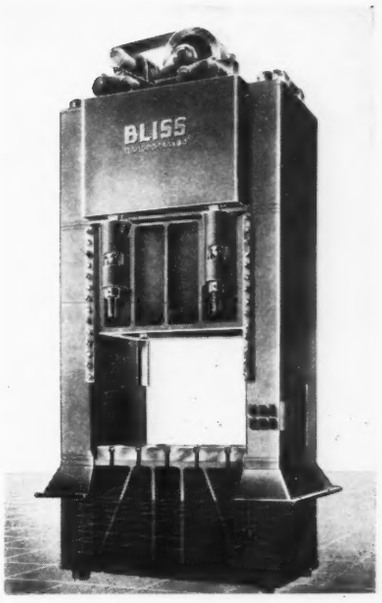
The cross-slide has a working stroke of 12.2 inches, and feeds ranging from 0.0005 to 0.50 inch. A 6- to 12-H.P., 1000- to 1500-R.P.M. motor is used for the drive. The floor space required is 9 feet 10 inches by 3 feet 4 inches.

Bliss Double-Action Toggle Presses Designed for High Production

A new series of four-point, double-action, toggle drawing presses featuring quick advance and return speeds and exceptional accessibility for maintenance purposes has been developed by the E. W. Bliss Co., Canton, Ohio. These presses are designed to meet the needs of the automotive and allied industries by making possible higher production rates for large-area, drawn stampings.

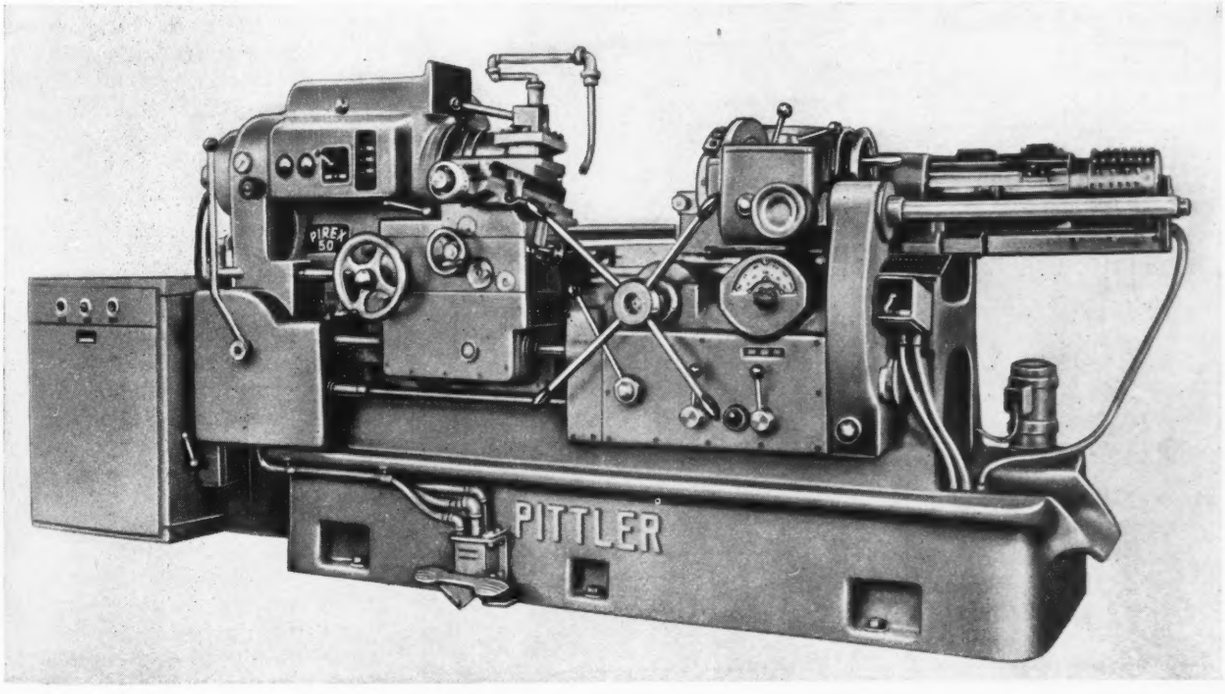
This has been accomplished through the use of the "eddy current drive clutch," which provides for quick approach to the work, slow-down to give proper drawing speeds, and quick return speed. Even with comparatively slow drawing speeds, a rapid press cycle is possible. The slow-down is accomplished by controlled slippage of the "eddy current drive clutch" through limit switches which can be adjusted to vary the speed of any portion of the draw cycle.

There are three substantial cross-members in the crown, which contains four totally enclosed gears with integral eccentrics for operating the plunger slide. All gearing and toggle bearings inside the crown are lubricated by a cascade oil system.



Bliss double-action toggle press designed for high production

Each main rocker shaft is in one piece, and is easily removed from the top of the crown by unshrinking the rocker-shaft bearing cap tie-rods with Calrod units. The intermediate rocker shafts are also removable from the top of the crown. Provision has been made for the use of pneumatic die cushions in the bed, or the bed can be fitted with a synchronized third motion if required.



Pittler "Pirex 50" lathe introduced by the Cosa Corporation

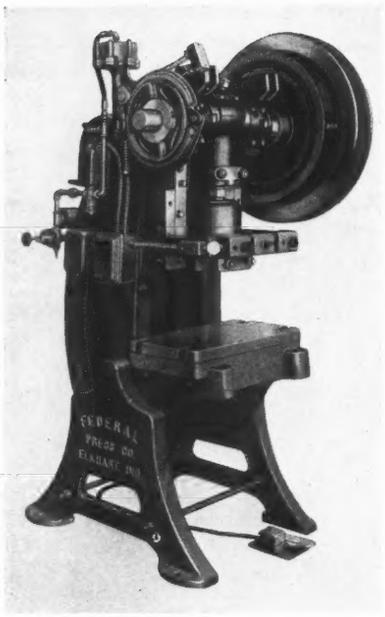


Fig. 1. Federal press equipped with new "Smooth-Air" clutch

Federal Press Equipped with "Smooth-Air" Clutch

The Federal Press Co., 505 Division St., Elkhart, Ind., has redesigned its line of punch presses to include a new electro-pneumatically controlled clutch-brake mechanism, known as the "Smooth-Air." The application of this improved equipment has been made in cooperation with a leading manufacturer of industrial clutches and brakes.

Operation of the new clutch is by compressed air, which expands a rugged rubber and fabric actuating tube molded to the structure of the flywheel. Any degree of clutch grip required can be obtained by controlling the expansion of the rubber and fabric tube. Full operating torque results from 360 degrees of pressure applied near the maximum diameter of the flywheel. Provision is made for overload protection.

The spring-tension brake is also released by compressed air. A solenoid synchronizes the air actuation of the brake and clutch. New electro-pneumatic controls permit single tripping (with hand push-button or foot control), as well as continuous operation. The non-repeat mechanism gives the desired protection in single-trip operation. The control panel also includes an "inching" button.

Elimination of mechanical levers or linkage makes possible split-second control. Operating shocks are absorbed by the rubber actuating tube, which also compensates for uneven wear of friction shoes and insures complete engagement with the clutch drum.

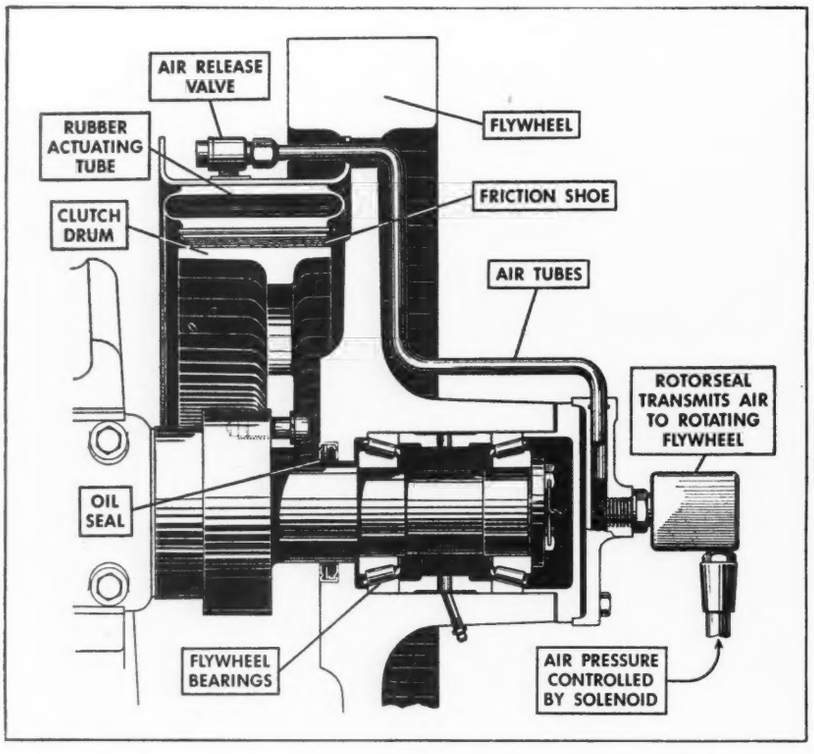
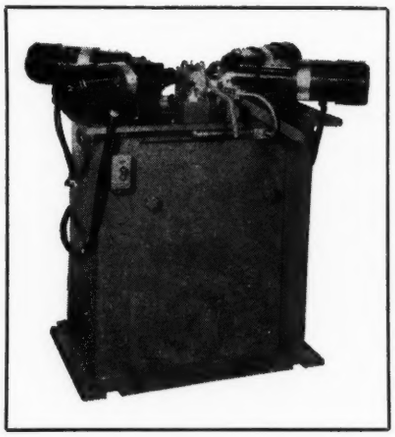


Fig. 2. Diagram illustrating operation of new clutch used on Federal press shown in Fig. 1

Special Multiple-Spindle Machine for Spot-Drilling

The difficult operation of drilling five spots in a small brass ball simultaneously is successfully performed on a special machine recently built by the Govro-Nelson Co., 1933 Antoinette, Detroit 8, Mich. This machine incorporates four Model KH Govro-Nelson drilling units, mounted horizontally to drill four spots 0.140 inch in diameter, and one unit mounted vertically to drill a 0.154-inch diameter hole upward in the ball.



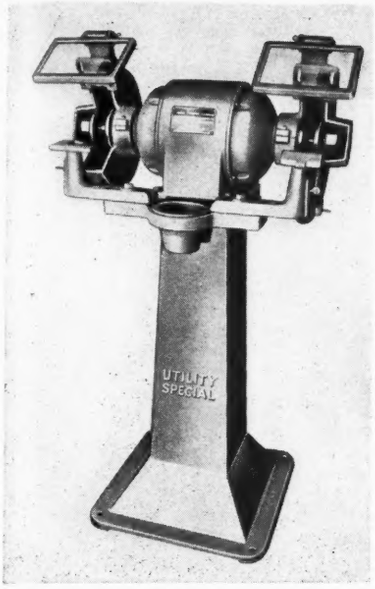
Govro-Nelson machine designed for the rapid drilling of five spots in a small brass ball simultaneously

The work is loaded manually into the machine. After the drilling operation, the manual unclamping action automatically ejects the part into a chute. With this setup, the five operations are completed at the rate of one part each four seconds, including loading and unloading time.

Reuland Medium to Heavy Pedestal Grinder

The Reuland Electric Co., Alhambra, Calif., has announced the development of a new line of low-cost pedestal grinders, buffers, and sanders. These units incorporate the company's own motor and many new work-saving features. They are suited to all types of medium or heavy-duty shop work.

Typical features include wheel guards that can be so adjusted as to make the grinding surfaces on worn wheels always accessible, thus assuring maximum use of wheels; adjustable tool-rests; hinged guard cover which can be



Reuland pedestal type grinder

flipped up to expose entire wheel of maximum 14- by 2-inch size; extra large, adjustable safety plate eye shields; and manually operated starter switch furnished as standard equipment, with magnetic starter optional.

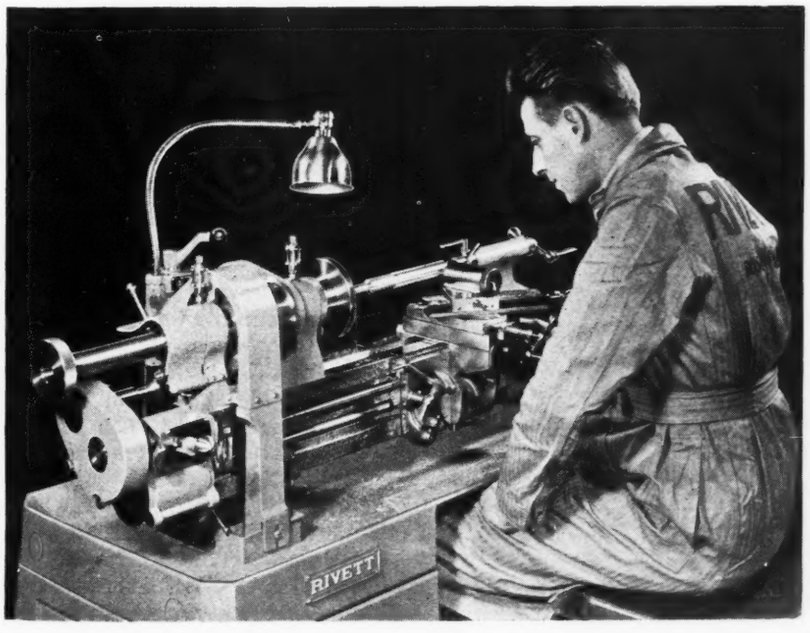
The Reuland "Utility" special grinder shown here has a totally enclosed induction motor with over-size ball bearings sealed and lubricated for life. It is available for operation on 110- and 220-volt single-phase, or 208-, 220/440-, 380-, and 550-volt three-phase 50- or 60-cycle current.

Rivett Precision Instrument Lathe

An instrument lathe designed for extremely accurate work is being introduced by Rivett Lathe & Grinder, Inc., Department MR-2, Brighton 35, Boston, Mass. This Model 608 lathe has a swing of 8 1/2 inches and is guaranteed to turn or bore work held in the collet or between centers to within 0.0001 inch in 6 inches. It is a back-geared, screw-cutting type engine lathe, suitable for a wide variety of work. Attachments are available for milling, spiral cutting, slotting, relieving, taper turning, radius turning, grinding, and forming. This equipment permits the user to complete an entire series of metal-cutting operations, utilizing the inherent precision of the lathe.

The lathe design provides for more than ample slide areas, equalling those of most lathes twice its size. The bronze-bearing spindle is designed to insure the highest accuracy and finish.

Performance within the guaranteed limits is safeguarded by a three-point bed mounting; a double-bevel alignment for headstock and tailstock; a carriage bearing of 76 square inches on the bed ways; separate lead-screw for thread cutting; double-taper, self-aligning spindle bearings; and a heat-treated, precision-ground feed-screw.

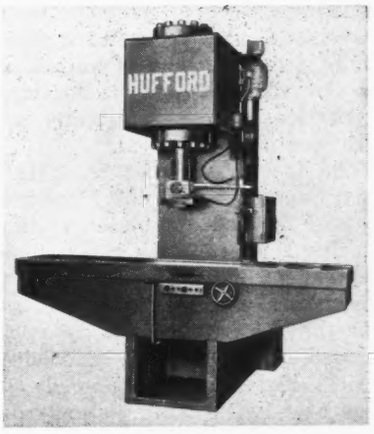


Precision instrument lathe recently placed on the market by Rivett Lathe & Grinder, Inc.

Hufford Straightening Press

A precision hydraulic straightening press for extremely sensitive work is now being built by Hufford Machine Works, Inc., El Segundo, Calif. An unusual feature of this press is an automatic stroke limiter, which provides protection against overbending of the work—an extremely important consideration in certain phases of aircraft manufacture.

A vertical shipper-rod attached to the side of the press frame is



Hufford straightening press with safety feature that prevents overbending of work

linked to a hand-lever, which serves as a manual control for the press. In shifting this rod up or down, fluid volume from the variable-volume pump is increased or decreased in proportion to lever displacement. A stop, attached to the shifting rod, is engaged by the ram in its descent, causing the volume of fluid from the pump to be gradually brought to the zero point. Thus the ram can be automatically halted at any predetermined position.

To accomplish rapid stroke alterations, a special attachment is furnished. In this case, a threaded shipper-rod is rotated by a reversible motor controlled by push-buttons. The stop, being threaded to this lead-screw, is thus automatically shifted up or down as rotation occurs. Final micrometer settings are made by means of a handwheel connected to the screw by a gear-box. One handwheel revolution equals 0.125 inch of ram travel. An automatic counter indicates ram extension to within 0.010 inch from the starting posi-

tion, and a dial gage shows the applied force within a range of 0 to 150 tons.

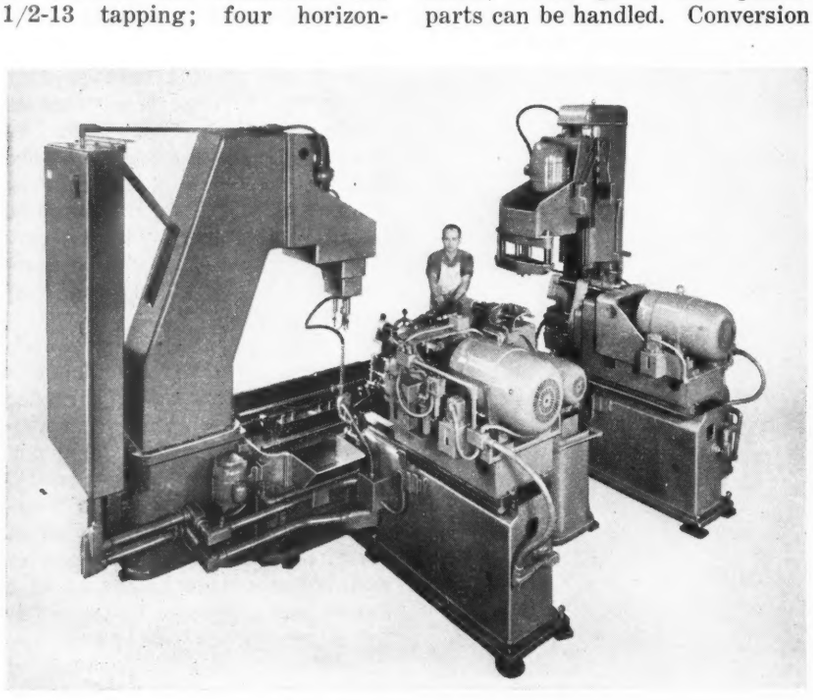
Maximum daylight capacity of this press is 30 inches, minimum daylight capacity 10 inches, and throat depth 19 inches. The table size is 21 by 108 inches. Pressing speeds of this machine range from 0 to 48 inches per minute, and retracting speeds from 0 to 65 inches per minute.

Buhr Five-Way Hydraulic Feed Drilling and Tapping Machine

A five-way hydraulic-feed drilling machine with individual lead-screw tapping equipment, for use in processing suspension supports for Army tanks, has just been completed by the Buhr Machine Tool Co., Ann Arbor, Mich. The holding fixture is mounted on a carriage, and is transferred manually from station to station as eleven drilling and chamfering operations and nine tapping operations are performed.

An interesting feature of this machine is the electrical interlocking of the fixture at each station during the machining cycle. This equipment prevents any forward movement from being started until the fixture is properly positioned. All hydraulic and electrical installations are made to conform with J.I.C. standards. The machine ways are of tool steel, hardened and ground, and automatically lubricated.

The operations performed by the automatic cycle are as follows: At Station 1, three vertical holes are drilled and chamfered for 1/2-13 tapping; four horizontal holes are drilled and chamfered for 1/2-13 tapping; and two holes are drilled for 3/4-inch tapping. At Station 2, two holes are drilled and chamfered for 1/2-13 tapping. At Station 3, three vertical 1/2-13 holes and six horizontal 1/2-13 holes are tapped.

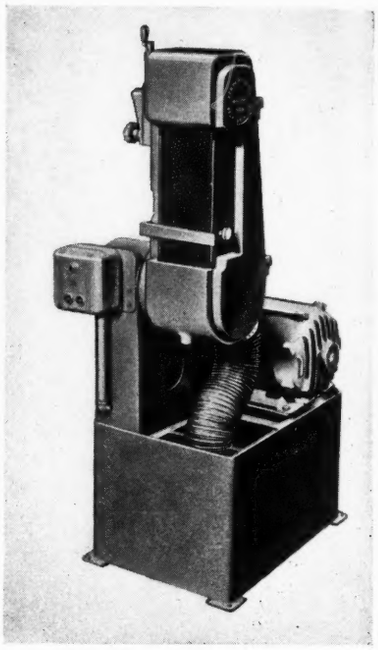


Special machine for drilling and tapping part for Army tanks, built by the Buhr Machine Tool Co.

Porter-Cable Abrasive-Belt Grinder

An all-purpose belt grinder designed for a wide range of grinding operations has just been placed on the market by the Porter-Cable Machine Co., Syracuse 8, N. Y. This grinder, which is equipped with a standard 6-inch abrasive belt, running over a 12 1/2-inch platen, is adapted for the economical handling of medium-size work.

It is intended primarily for free-hand applications on work requiring the grinding of flat surfaces, deburring, squaring, chamfering, rounding, and polishing. Metal, wood, glass, and plastic parts can be handled. Conversion from vertical to horizontal operation requires only a minute, and is accomplished by simply loosening two hexagonal nuts.



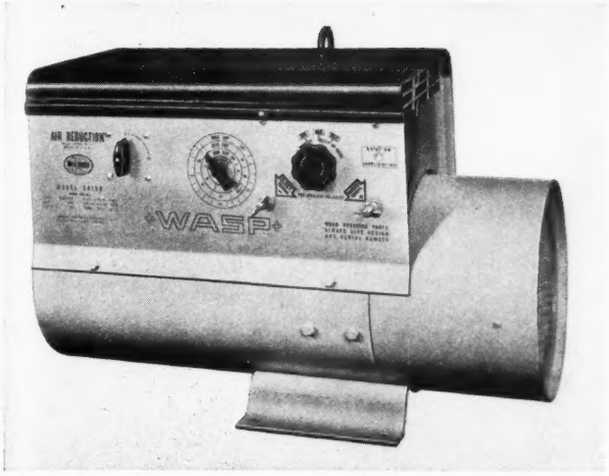
All-purpose abrasive-belt grinder placed on the market by the Porter-Cable Machine Co.

The grinder is equipped with two-speed pulleys for surface grinding speeds of 3300 and 4000 feet per minute. The speeds can be quickly and easily changed to suit different materials. An optional set of pulleys providing surface speeds of 2400 and 5500 feet per minute is also available.

This machine has a built-in coolant system. Coolant is sprayed on the belt by the action of the pump to flush away grindings. The coolant then runs downward through a flexible dust tube, and is filtered twice before re-entering the pump.

In the horizontal position, the machine is 38 inches high, 18 inches wide, and 30 3/4 inches deep, while in the vertical position, it is 56 1/2 inches high, 18 inches wide, and 25 inches deep. The weight of the dry grinding model, without motor, is 350 pounds, and the weight of the wet grinding model is 380 pounds.

The drive unit for the machine is a 3-H.P., 220/440-volt, 60-cycle, three-phase, 1750-R.P.M. totally enclosed motor with across-the-line starter and wiring. A worktable, 10 inches wide by 7 inches deep, which is adjustable to an angle of 45 degrees, is available.



Direct-current arc-welder of improved design announced by the Air Reduction Sales Co.

"Electraulic Liftable" for feeding presses made by Service Caster & Truck Corporation

Airco Direct-Current Arc-Welders

New Model GA "Wasp" direct-current arc-welders in 150- and 200-ampere sizes have been announced by Air Reduction Sales Co., Division of Air Reduction Co., 60 E. 42nd St., New York 17, N. Y. The volt ampere characteristics of these machines are said to make them especially suited to direct-current, straight-polarity "Heli-welding" with "Thor-Tung."

Excellent commutation at all settings, plus the advantages of self-excitation and split-pole, cross-field design, is claimed to provide good operation at all current settings. Continuous overlap from each current range to the next provides a wide, unbroken range of welding current of 30 to 250 amperes on the 200-ampere welder and 20 to 185 amperes on the 150-ampere machine.

These light-weight models are readily movable when mounted on a two-wheeled carriage, and require small floor space.

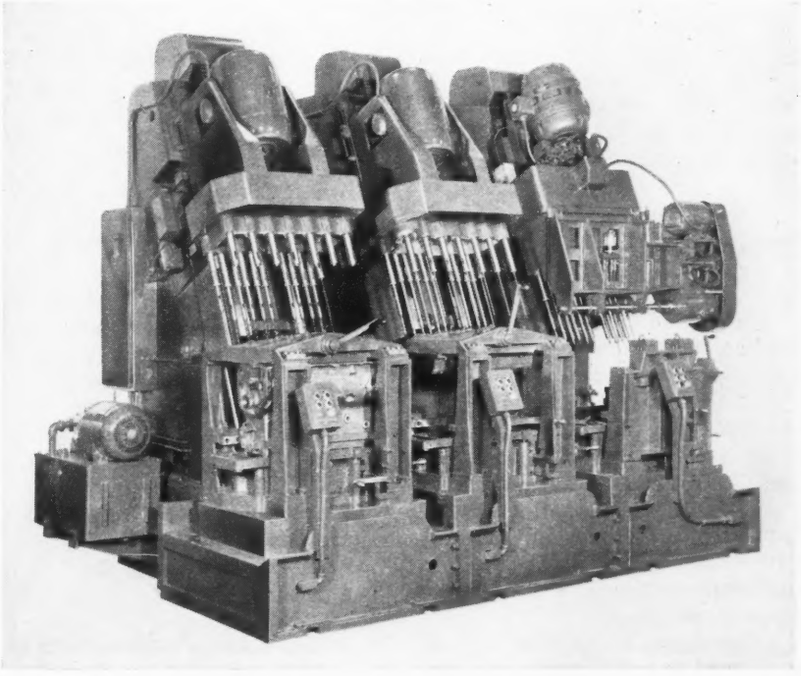
"Electraulic Liftable" for Presses

An "Electraulic Liftable" designed to maintain the top of a stack of metal sheets at the feeding level of a press is being manufactured at the Somerville, Mass., plant of the Service Caster & Truck Corporation. This new feeding equipment is designed to operate continuously with production presses, and is available in capacities up to 15 tons. It can also be built to operate with the press, through one set of controls. The "Liftables" can also be used to receive cut or stamped products after processing.

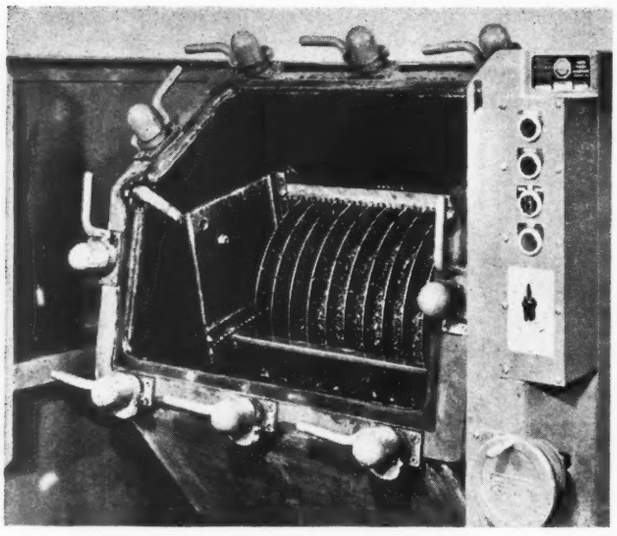
Deck sizes of the machines vary from 36 to 54 inches wide by 66 to 120 inches long. A raised height of 42 inches is easily obtained from a lowered height of 26 inches.

LeMaire Special Machine for Drilling, Tapping, and Milling Crankcases

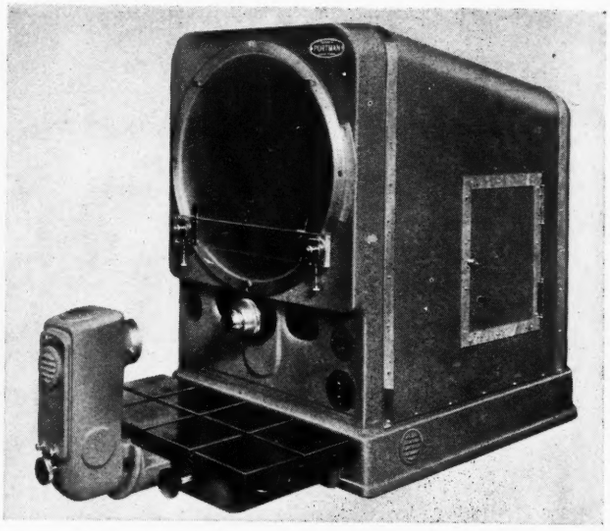
A three-station manual transfer machine developed to drill, spot-face and mill main-bearing insert lock-grooves in cylinder upper crankcases has been built by the LeMaire Tool & Mfg. Co., 2657 S. Telegraph Road, Dearborn, Mich. This machine consists of three angular columns, with slide type drilling units at the first and second stations and an eighteen-spindle drilling head at each of these stations; and a slide type unit at the third station, with an eleven-spindle tapping head and a seven-cutter milling unit.



LeMaire three-station transfer type drilling, tapping, and milling machine for cylinder upper crankcases



Stationary fixture type cylinder finishing machine made by Roto-Finish Co.



Bench type optical comparator placed on market by Portman Instrument Co.

Three individual fixtures are arranged with rollers, so that the crankcase can be easily moved by hand from station to station. The part is moved to a rough stop in each cylinder, and then lowered over locating plugs in each end cylinder bore and against the adjacent head face. Four different cylinder blocks are handled on this machine through fixture changes and interchanging of tools.

Not all spindles are used on all four parts, certain tools being left out as required. The tapping head and milling unit are carried on a hydraulic feed slide unit that provides the feed for the milling cutters. As the milling cutters are being fed into the work, the taps are also fed in, reversed, and backed out by individual lead-screw spindles. Production is about seventeen parts per hour.

Stationary Fixture Machine Added to Roto-Finish Line

A new addition to the line of mechanical finishing machines manufactured by the Roto-Finish Co., Kalamazoo, Mich., known as the DW 30-36-1SF, has been especially designed to finish disc type circular parts at low cost. This machine is of the stationary fixture type, and uses the directional flow of the finishing material to uniformly and efficiently produce the desired finish.

It has a single 30 1/8- by 35 1/4-inch rubber-lined tumbling compartment with a capacity of 18 cubic feet. The large door opening facilitates handling the large size parts for which the machine was designed. Patented quick-action cam locks, used for closing the compartment door, have spring-loaded pressure releases, which prevents excessive pressure build-up in the work chamber.

Features include push-button operation, with all controls located on one panel. Once the machine is started, an automatic timer controls the operation up to twenty hours without attention by an operator. A variable-speed power unit with a remote control handle enables the operator to vary the speed of the rotating cylinder from 10 to 30 R.P.M.

Portman Production Model Optical Comparator

The "Olympic" Model B-50 bench type optical comparator recently announced by Portman Instrument Co., 6 Manhasset Ave., Port Washington, N. Y., has several entirely new and advanced features, including a 16-inch diameter image and a plain horizontal work-stage platform. This comparator is equipped with a "Super-Light" condenser lens unit which is exhaust power cooled. The light source may be used with color filters to vary the intensity and shading of light on the screen. The special "Ciptar" objective lens elements used provide maximum light, large objective areas, and sharp definition at all powers, with the advantages of an upright image. The six magnifications range from 10X to 100X, and are obtainable as standard equipment.

The working stage area is 6 by 16 inches, and is so designed that production type fixtures can be readily mounted for various classes of work. The image screen also has provision for the mounting of overlay chart holders, in order to facilitate the changing over of charts from one job to another.

This comparator can be used anywhere in the shop or production line under prevailing lighting conditions without the need for extra screen covers or hoods. Over-all dimensions are height, 30 inches; width, 20 inches; and depth, 45 inches. The weight is 350 pounds.

Gouging and Chamfering Electrode

A new electrode designed for gouging, chamfering, cleaning and material-removing operations on any metal or alloy has been announced by Eutectic Welding Alloys Corporation, Department P, 172nd St. at Northern Blvd., Flushing 58, N. Y. Important savings in time are claimed for this product (called "ChamferTrode") when it is used for fabricating armor plate and similar alloys that are difficult to cut. The new electrode can be used to speed up many machining operations.

"ChamferTrode" has a heavy coating, which forms a cone at the striking end, providing a natural jet effect arc. Thus an intense, concentrated source of heat is

created, which readily removes unwanted metal of all types so swiftly that the metal, itself, remains relatively cool. Surfaces gouged or chamfered by this electrode are said to be free from oxidation and slag.

The chamfering blast is so concentrated that warping of thin material is said to be negligible, and in all cases, the physical properties of the base material are claimed to be unaffected. In addition, the heavy coating is said to be specially designed so that arc establishment is momentarily delayed, thus enabling the operator to place the electrode exactly at the precise point at which he wishes metal to be removed before lowering his shield or protective glasses to proceed with the work. Regular direct-current welding machines are used as the power source.

Recessed Pull for Pressed-Steel Cabinet Drawers and Knock-Down Shop Stools

Recessed four-finger pulls or grips for metal cabinet drawers designed, as shown in Fig. 1, to give a more attractive flush front and promote safety in shop and office have been developed by the Standard Pressed Steel Co., Jenkintown 19, Pa. A new knock-down shop stool made in three sizes, each of which has a height adjustment range of 4 inches, is another new product of this company. These stools, shown in Fig. 2, can be shipped or stored knocked down in cartons of comparatively small size.

Fig. 2. Knock-down type shop tools designed for economical packaging

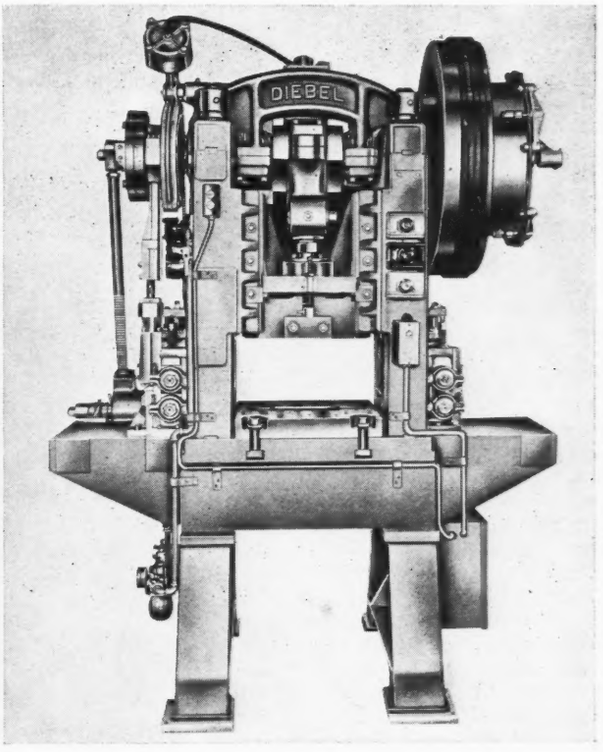
"Hi-Production" Fully Automatic Press

The Di Machine Corporation, 2711 W. Irving Park Road, Chicago 18, Ill., has developed a "Hi-Production" fully automatic press known as the "Diebel Di-Matic." This 40-ton press is designed to meet exacting requirements for both accuracy of alignment and operating speed in precision stamping. It is adapted for producing intricate parts from complicated progressive dies.

An outstanding feature is the four main crankshaft bronze bearings, developed to assure longer press life. Other important features are an air-operated and electrically controlled friction clutch and brake; air ejector and cam; metered lubricating system; cylindrical slide, 16 inches in diameter, guided by adjustable retainers with 380 square inches of contact area.

Also provided are a knock-out bar for compound dies and a built-

Fig. 1. Metal cabinet with recessed drawer pulls developed by Standard Pressed Steel Co.



"Diebel Di-Matic" press recently placed on the market by the Di Machine Corporation

In scrap-cutter; 5-H.P. variable-drive motor; air clamped roll feed driven by rack and pinion with Formsprag over-running clutch equipped with double ball bearings; and specially designed spring and rubber shock mounts. Provision is made in the electrical control circuit for the use of a safety shut-off device.

New Welding Rods

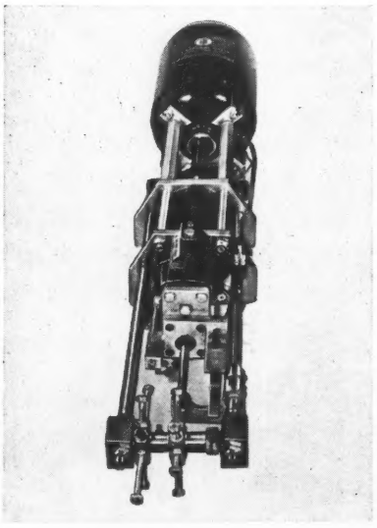
An important advance of especial interest, not only to the defense effort but also to manufacturers of a wide variety of aluminum products for civilian use, is said to have been made through the introduction of two new high-purity bare welding rods by the All-State Welding Alloys Co., Inc., White Plains, N. Y. These rods are equally applicable with alternating- or direct-current electric welding equipment and oxy-acetylene welding equipment. Competitive tests are said to have accorded these rods the highest ratings in weldability, smooth finish, speed of application, and uniform results.

The new rods are identified as X-43S aluminum rod meeting Government Specification QQ-R-566 Type 1 Class FS-RAL-43, and X-2S aluminum rod meeting Government Specification QQ-R-56 Type 1 Class FS-RAL-2.

Both rods are designed for all work requiring 43S or 2S aluminum wire applied with inert gas, normal arc, or torch. Standard diameters include 1/16, 3/32, 1/8, 3/16, and 1/4 inch, and the standard length is 36 inches.

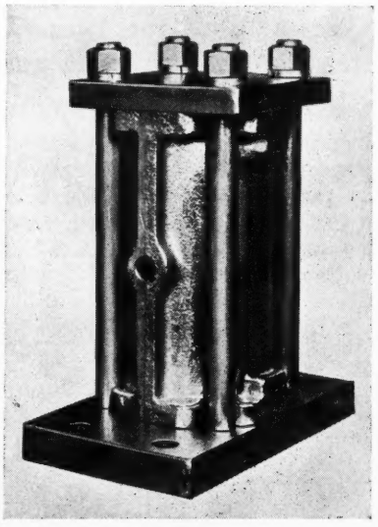
Grinding Wheel Mount Designed to Eliminate Vibration

The Chicago Wheel & Mfg. Co., 1101 W. Monroe St., Chicago 7, Ill., will display for the first time at the A.S.T.E. Show (Booth 314) a revolutionary new mounting for grinding wheels used on portable tools and tool and cutter grinders. It is claimed that this new mounting dampens vibrations and gives better finishes on almost any grinding job, eliminating the necessity of changing the wheel to obtain a smoother finish. Longer wheel life and reduced operator fatigue are also said to be obtained. The new mount, besides being applicable to portable tools and tool and cutter grinders, can be used on bench grinders.



Schrader Air-Operated Ferrule Contracting Machine

Air-operated ferrule contracting machine developed by the A. Schrader's Son Division of Scovill Mfg. Co., Inc., 470 Vanderbilt Ave., Brooklyn 17, N. Y., to make possible the high-speed production of uniformly fitted hose lengths. Interchangeable dies enable the machine to be set up quickly for various sizes of ferrules. The foot-pedal control permits the use of both hands in feeding and removing the work, reducing operator fatigue and speeding production.



Black Drilling Unit Designed for Long Travel and Skip Stroke

Traversing motor-shaft type drilling unit with a 4-inch working travel and a skip-stroke attachment, designed for deep drilling, drilling in inaccessible locations, and accurate drilling in materials requiring frequent chip clearing. Developed by the Black Drill Co., Inc., 1400 E. 222nd St., Cleveland, Ohio. This unit is designed to operate in any position. Air feed provides rapid, shockless advance to the work, and hydraulic control provides uniform drill feed, even when the drill is breaking through. A micrometer stop insures a depth accuracy of 0.001 inch. From one to six skip-stroke stops are provided. Interlocking and auxiliary controls are easily installed. This drilling unit is made in 1/4- to 5-H.P. sizes.

End-Mounted "Quiet Type" Vibrator

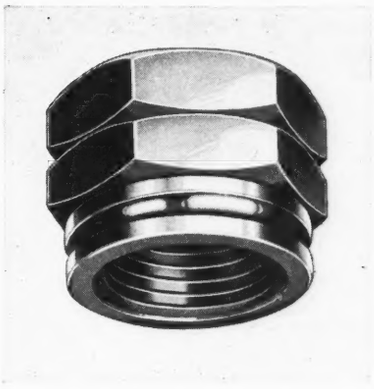
New 5-inch vibrator recently added to line of end-mounted "Quiet Type" vibrators made by the Cannon Vibrator Co., 1111 Power Ave., Cleveland 14, Ohio. This vibrator, known as the EM-5-QH, weighs 180 pounds and is said to be the largest end-mounted pneumatic vibrator made. Its 55-pound piston has a stroke of 1 5/8 inches and operates at a maximum rate of 650 strokes per minute with an operating pressure of 80 pounds per square inch. Air-cushioned operation eliminates metal-to-metal pounding for semi-noiseless operation. It is claimed that by using an extra long stroke, this vibrator sets up a reaction in the entire assembly, thus creating an effective, long amplitude vibration. It was designed for use on large storage bins having a capacity of 75 tons or more.

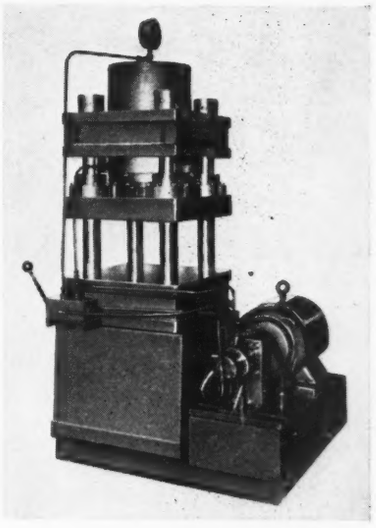
Pressure Regulator for Precision Control of Air Flow

Precision regulator developed to give exact control of pressure in the range of 0 to 30 pounds per square inch at 9 to 2 cubic feet per minute. This regulator is especially suited for use with air-controlled instruments, but is also applicable to any process requiring air, nitrogen, or other inert gases, the pressure of which must be precisely controlled. The unit operates on primary line pressures up to 400 pounds per square inch, with delivery pressures ranging from 0 to 30 pounds per square inch. A built-in relieving feature prevents a build-up of excessive pressure. Will be exhibited in action by the O. A. Norgren Co., 3419 S. Elati, Englewood, Denver, Colo., at the A.S.T.E. Show.

Klincher Free Running Lock-Nut

Seating type, all-metal lock-nut brought out by Klincher Locknut Corporation, 2153 Hillside Ave., Indianapolis, Ind. The grooved washer at the bottom of the nut is pressed over a threaded section projecting from the main body of the nut. The nut spins freely on the bolt down to the work. When the proper torque has been applied, the washer is compressed, causing the threaded section inside it to move in radially and become locked to the bolt. The threaded section then elongates a few thousandths of an inch, permitting the bulk of the load to be taken by the main body of the nut, thus reducing the high stress concentrations. The nut is manufactured in various materials, and will withstand temperatures up to 1600 degrees F. without thread seizure. The all-metal construction of this nut permits it to be removed and replaced without destroying its holding power.



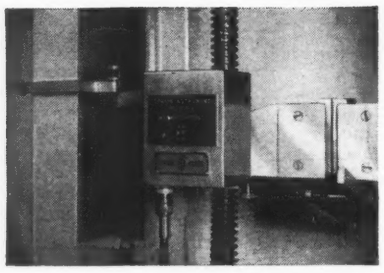


Hydraulic Press for Hobbing and Closed-Die Forging

Low-cost hydraulic press for hobbing and closed die forging, announced by Oilpower Engineering Co., 1067 Davis Terrace, Schenectady 3, N. Y. This press, of four-column design and all-welded steel construction, is one of a new line manufactured in various bed areas and ram strokes, with capacities from 100 to 1000 tons. The 400-ton press shown has a bed area of 20 by 25 inches, a ram stroke of 12 inches, and a daylight capacity of 16 inches. It is intended for hobbing, and is powered by a 10-H.P. motor. The height of the press is 7 feet. The down-moving, double-acting cylinder is of forged steel.

Giant Vacuum Printing Frame for Producing Templates Photographically

Giant vacuum printing frame for producing templates by the photographic method. Announced by the Miller-Trojan Co., Inc., 1083 W. Main St., Troy, Ohio. A printing frame like the one shown has recently been installed by two aircraft manufacturers. This printing frame for producing photographic metal templates, when used in conjunction with a simple photographic process, eliminates the necessity for laying out the design on the template by hand. It is equipped with a bank of instant-start, slim-line fluorescent tubes, which assures quick, even exposure. One, two, or three circuits with gold, green, or black fluorescent tubes, respectively, are available. The over-all printing area is 68 by 144 inches. An automatic timer permits unsupervised exposures from one second to several minutes. The large vacuum pump has three intakes to assure a quick acting vacuum.

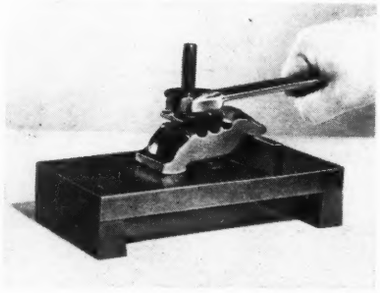


Tinius Olsen Strain Instruments

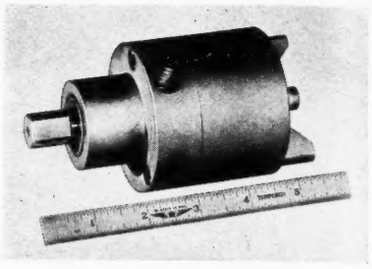
Low-magnification strain instrument made by the Tinius Olsen Testing Machine Co., 1052 Easton Road, Willow Grove, Pa. Available in three models. The C-1 model has magnifications of 10, 20, and 40; the C-2 model, magnifications of 1, 2, and 4; and the C-3 model, magnifications of 2 1/2, 5, and 10. When used in conjunction with the S type extensometer, complete stress-strain curves can be produced automatically without stopping the tests. The new instruments are used to detect large motions of specimen deformation in tension, compression, and flexure testing. Signals are transmitted by means of special Atcotran differential transformers, which rotate the recorder drum in direct proportion to the motion measured. The instruments may also be used as deflectometers. They weigh only 2 1/2 pounds.

Self-Setting Clamps for Presses and Machine Tools

New "Autoset" self-setting clamps for presses and machine tools, designed to eliminate packing and save setting time. These clamps have three interrelated curved contact surfaces, as indicated in the illustration. They have been evolved to meet any normal clamping requirement on power and hand presses, lathes, drilling machines, milling machines, shapers, planers, grinders, etc. Available in sizes ranging from 3 inches long with 1/4 inch to 1 1/8 inches



height capacity to 8 inches long with 1 1/8 to 3 3/4 inches height capacity. This range of sizes includes six different bolt diameters ranging from 5/8 to 1 inch. Recently placed on the market by the Alpha Tool & Supply Co., Box 119, Westwood, N. J.

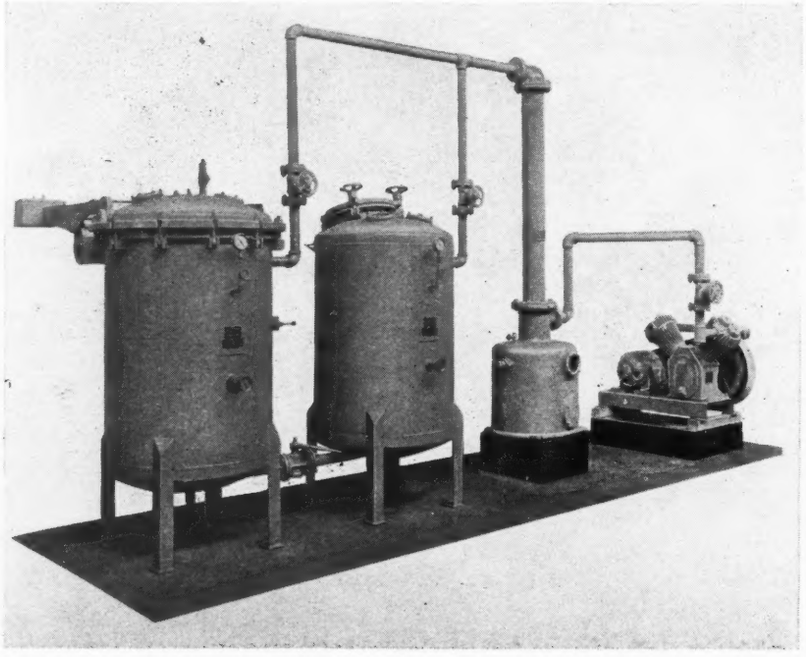


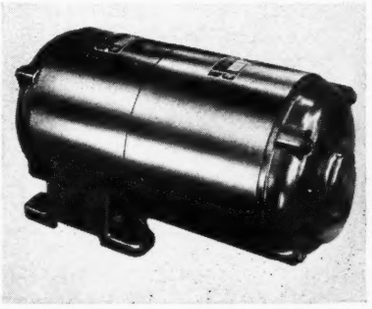
Compact Pump for Light Fluids

New "Magna-Mite" low-priced, positive-displacement pump of compact design, announced by Milwaukee Hydropower, Inc., 3447 N. 35th St., Milwaukee 16, Wis. With a pumping capacity of from 1 1/2 gallons down to 1/4 gallon per minute, this pump is suitable for handling fuel oil, gasoline, hydraulic fluid, lubricating oils and other light viscosity fluids. It is similar to vane type pumps in operation and construction, but has an important difference in that the conventional vanes are replaced by rollers, which is said to increase the life of the pump from three to five times. The new pump has a diameter of only 2 3/4 inches, and is 6 inches long. Available in a choice of three major types — constant displacement; adjustable displacement; and variable and reversible displacement. All three types will operate in either direction of pump rotation and in any position.

Stokes Vacuum Impregnation Equipment

High-vacuum impregnation equipment, including impregnating tank and storage tank, manufactured by the F. J. Stokes Machine Co., Philadelphia, Pa. This equipment is designed for use in the manufacture of instruments, electrical equipment, and tools, and for filling thermometer tubes and containers with small openings. It is also applicable in the processing of foods, wood, leather, and various kinds of building and construction materials.



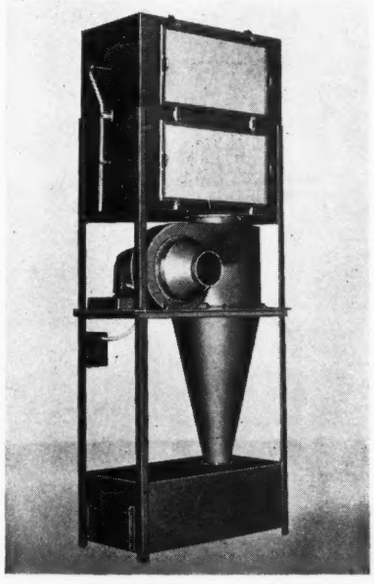


High-Frequency Power Supply Unit

New 400-cycle motor-alternator, meeting AN-E-19 requirements for power supplies, designed to require a minimum of maintenance. It utilizes no rotating coils, requires no brushes or springs, is small in size, and unusually compact. The laminated rotor is mounted in ball bearings, which are practically wear-free. Over-all dimensions are approximately 22 by 12 by 12 inches, and the weight is about 125 pounds. Outputs are furnished in wattages up to 1000, single phase, or 1800, three-phase. Single- or three-phase common-shaft motor drives are available. Product of American Electric Motors, 4811 Telegraph Road, Los Angeles 22, Calif.

Gear Drive for Screw-Feed Conveyors

Reduction gear drive designed with mounting flange for quick, convenient application to a 9-inch diameter screw-feed conveyor, as shown in the illustration. These gear reduction units are introduced by the Boston Gear Works, Quincy 71, Mass., under the trade name "Boston Reductor." They can be furnished with special diameter output shafts, and will be available for other sizes of screw-feed conveyors.

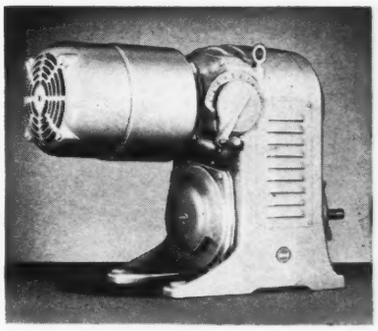


Large Capacity Dust Collector

Large capacity industrial dust collector that requires only 8 square feet of floor space and yet is capable of collecting the dust from as many as ten grinding wheels in simultaneous operation. The new Model 3050 "Dustkop" unit, announced by the Aget-Detroit Co., 135 Main, Ann Arbor, Mich., has a rated capacity of 3630 cubic feet of air per minute at a static suction of 6 inches, measured on an 8-inch inlet pipe. The dirt-laden air is drawn into the collector by means of a self-clearing paddle-wheel fan, driven by a 5-H.P. motor, and the cleaned air is returned to the working space with little loss of heat.

G-E Redesigned Atomic Hydrogen Welder

Atomic-hydrogen transformer welder incorporating a new hot-start circuit, silicone insulation, and an extra wide current range. Announced by the General Electric Co., Schenectady 5, N. Y. This redesigned welder is said to be quicker starting, more durable, and more versatile than the superseded model. The wide current range of 10 to 100 amperes allows the use of one machine for all applications. The welder operates on 60-cycle, single-phase current. It is 41 1/2 inches high by 18 3/4 inches in diameter, and weighs 350 pounds.

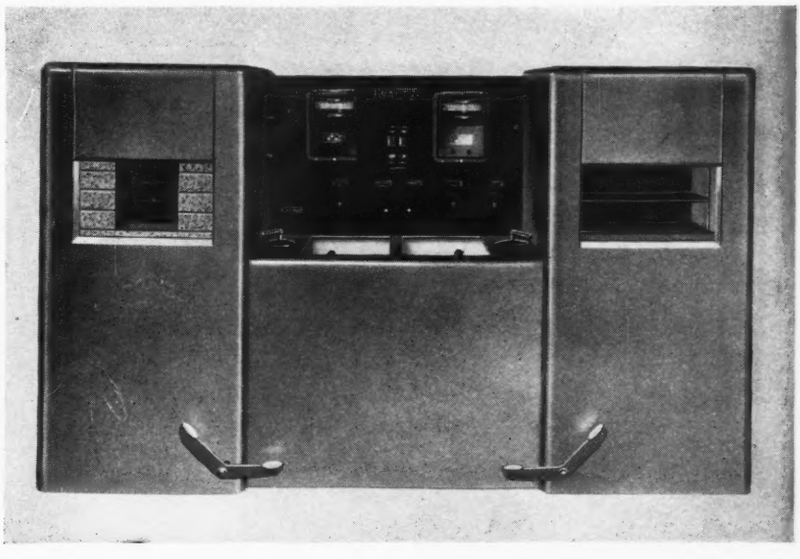


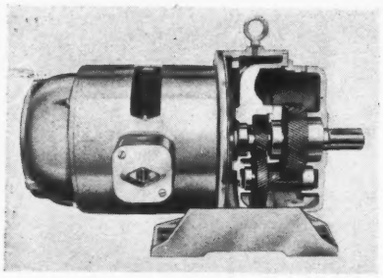
Variable-Speed Drive with Explosion-Proof Motor

Variable-speed drive unit developed to meet the demand for equipment that can be operated safely in hazardous locations where open sparks might cause explosions. This self-contained unit comprises an explosion-proof motor and "Varidrive" speed-changer, mounted in one frame and occupying a single base, which saves space and eliminates intermediate connections. The motor element is totally enclosed, and air is circulated over the enclosed unit from the exterior by a spark-proof fan housed within the end sector, the motor being mounted on the "Varidrive" assembly. Instant speed changing is accomplished by turning a control dial. The motor is available in ratings from 1 to 20 H.P., with output speeds of 2 to 10,000 R.P.M. Gear reducers can be incorporated as an integral unit. Product of U. S. Electrical Motors, Inc., 200 E. Slauson Ave., Los Angeles 54, Calif.

Compact Heat-Treating Unit

Small size, compact heat-treating furnace, brought out by the Waltz Furnace Co., Department M, 1901 Symmes St., Cincinnati, Ohio, to provide all the advantages of a full-scale heat-treating department. It is equipped for heat-treating all types of water- or oil-hardening steel, and can be used for annealing, normalizing, pack-hardening, and stress-relieving. The new furnace requires little floor space, and can be located anywhere in the shop.



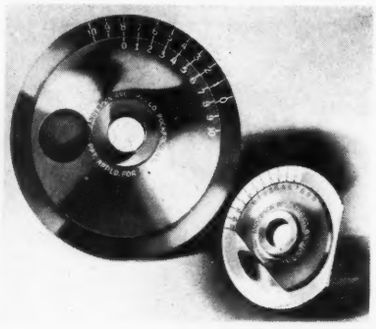


Gear Reducer with Internal Fluid Coupling

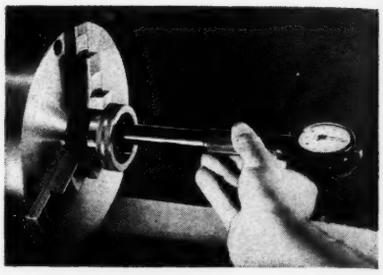
Reuland fluid-shaft motor and gear train, combined to form a single, compact unit designed to convert the conventional high speed of the motor into a slow-speed, high-torque output. The integral fluid coupling provides cushioned starting of heavy loads and protection against "jamming" of equipment. All gears operate in an oil bath, assuring positive lubrication. The helical gears are hobbed from special alloy steels to provide smoother, stronger, and quieter operation. Available with squirrel-cage, fluid-shaft, or slip-ring driving motor, either polyphase or single phase. Gear train can be either single or double reduction type. All units are available in either drip-proof or totally enclosed designs. Output speeds range from 1 to 600 R.P.M. in wide range of horsepower ratings. Product of Reuland Electric Co., Alhambra, Calif.

"Speedi-Balancer" for Balancing Grinding, Polishing, and Buffing Wheels

New balancing equipment known as the "Speedi-Balancer," recently introduced by Anderson Bros. Mfg. Co., 1907 Kishwaukee St., Rockford, Ill. This equipment is designed to quickly bring into balance grinding, polishing, or buffing wheels. With this device, wheels can



be removed and replaced without adding or removing weights. The wheel is marked to show the setting of the balancing discs, and any time it is removed or replaced on the lathe, the "Speedi-Balancer" is merely set according to the marking on the wheel. The balancers are made in sizes to fit arbor diameters from 1/2 to 7/8 inch and from 1 inch to 1 1/4 inches.

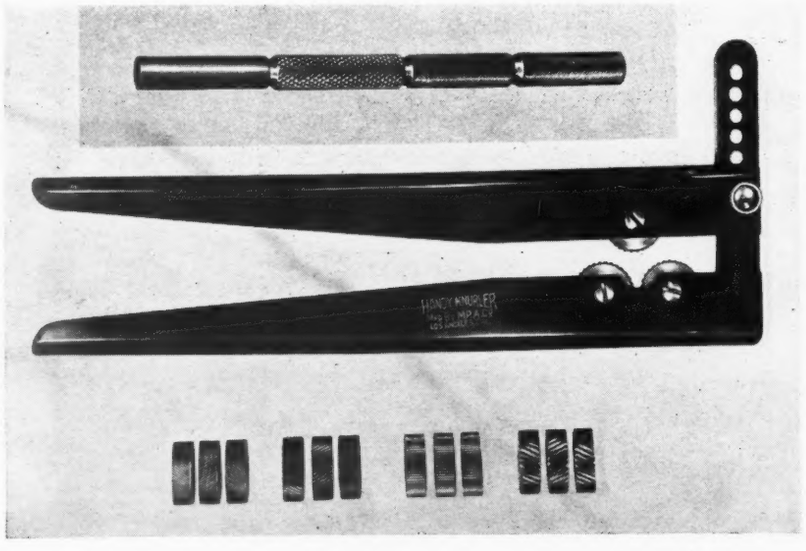


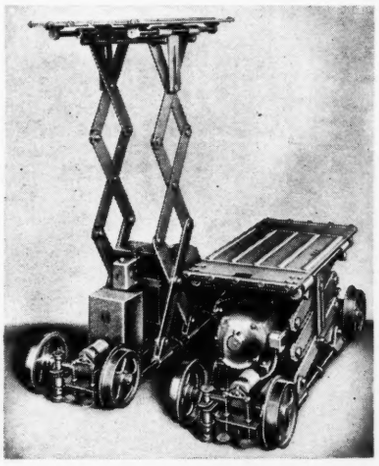
Boice Precision Dial Bore Gage

Dial bore gage designed for precision measuring of internal diameters. The dial gives instant, quantitative reading of size and condition of bore to 0.000025 inch. The equalizing pins are secured in a special head, designed to assure positive alignment. New type centralizing mechanism allows setting by use of gage-blocks, thus eliminating the necessity for master rings. Made in standard and pistol-grip models, and available in any length to meet special requirements. Tungsten-carbide and Norbide tips can be supplied. The gage is made in three sizes covering a range of from 1 to 6 inches. Produced by the Boice Mfg. Co., Poughkeepsie, N. Y.

Hand-Operated Knurler

New type knurling tool known as the "Handy Knurler," which has recently been introduced by the M.P.A. Co., 1678 W. 17th Place, Los Angeles 6, Calif. This is a hand-operated knurler that can be used on lathes, drill presses, or other machine tools. For hand knurling, the work can be held in a vise and the tool rotated around the work. The tool will accommodate parts ranging from 5/32 inch to 2 inches in diameter, and will knurl to any length desired. In operation, the knurler is held in the hand, like a pair of pliers. It will raise the surface on materials from a few thousandths of an inch to twenty- or thirty-thousandths of an inch, depending on the knurl pattern used. This feature permits it to be used to salvage under-size parts.



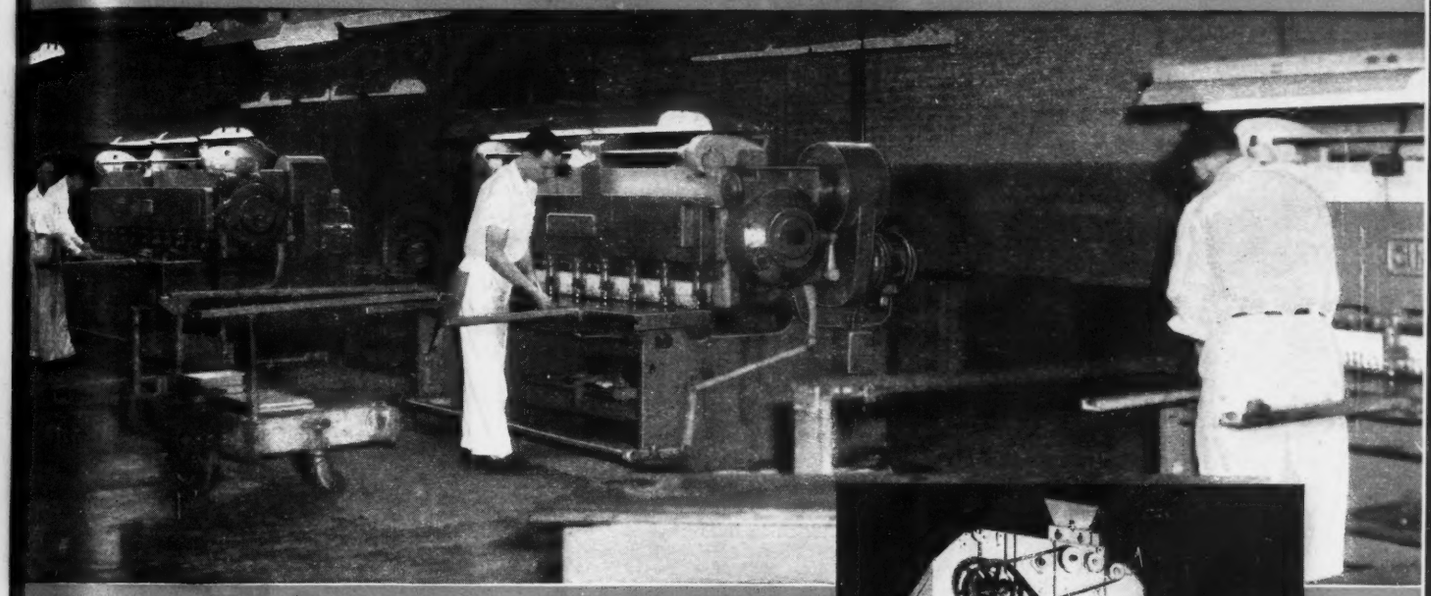


Special "Portelvator" for Handling Work in Process

Special "Portelvators" designed by the Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio, to meet the requirements of a complex work-handling job. They operate on tracks which skirt the storage shelves and processing stations; are moved manually from station to station; and are elevated electrically. The lift mechanism is of the scissor type, and operation is by 1-H.P. motor through standard "Portelvator" worm, worm-gear, and screw power transmission. The motor is actuated by foot control from either end of the table. Electrical controls include gear-driven limit switch and reversing magnetic starter. The table is 24 inches wide

3 CINCINNATIS

...shear 750,000 lbs. of steel every 22 days



THIS productive and dependable battery of Cincinnati Shears at the John E. Mitchell Company is shearing with accuracy in the manufacture of extracting, cleaning and drying equipment.

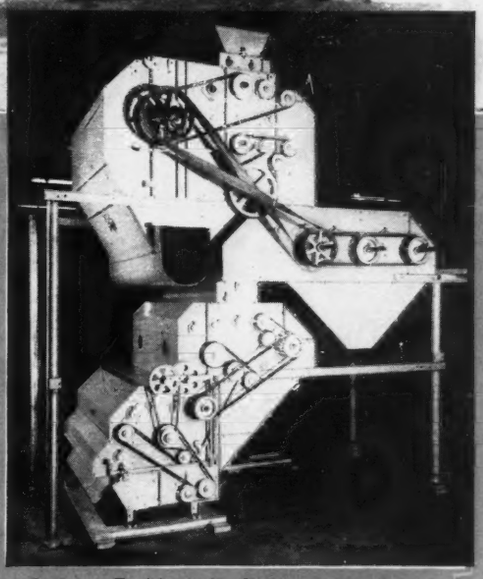
Freedom from shut downs, long knife wear, efficient, accurate gauging and general ease of control all contribute to this steady production.

C-1010 steel in 20, 16, 12 and 7 gauges is being handled.

A 6-foot, 8-foot and a 10-foot Cincinnati Shear make up the battery.

Cincinnati All-Steel Shears are economical producers, and their accuracy also reduces assembly costs.

Write for latest Shear Catalog—S-6—on the complete line of Cincinnati All-Steel Shears.



A John E. Mitchell Company combination machine used in cotton gins. Photos courtesy of the John E. Mitchell Company.

THE CINCINNATI SHAPER CO.

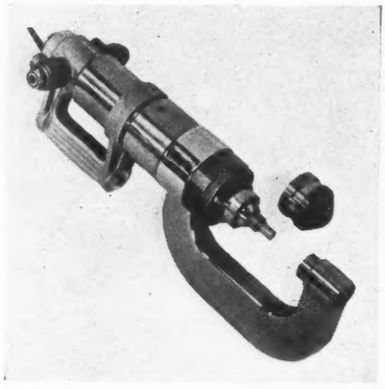
CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI

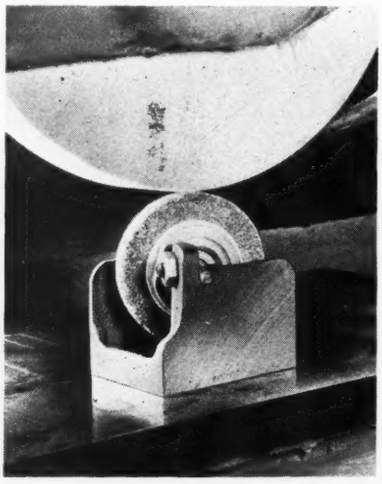
and 36 inches long; the lift, from 24 to 64 inches above floor level; and the load capacity, 600 pounds. The rate of lift is 40 inches per minute.

Danly Piercing Unit

The Danly Machine Specialties, Inc., 2100 S. Laramie Ave., Chicago 50, Ill., has announced the availability of a complete line of portable hydraulic piercing units incorporating automatic hydraulic stripping action. The new hydraulic power cylinder of this unit makes it extremely compact and completely hydraulic in action. The combination of light weight and high capacity achieved in the design is

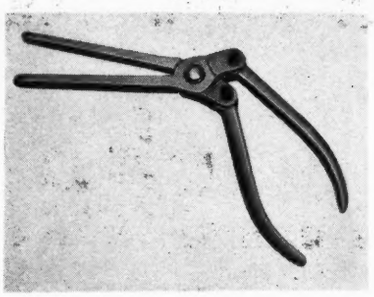


exemplified by the unit illustrated, which weighs only 45 pounds and yet exerts a force of 5 tons at 2000 pounds per square inch working pressure. Maximum capacities range up to 12 1/2 tons at 5000 pounds per square inch working pressure. These units are adapted for a wide variety of general metal-working operations, including riveting, trimming, bending, or extruding, as well as piercing. They are especially useful where heavy or awkward pieces make work handling difficult.



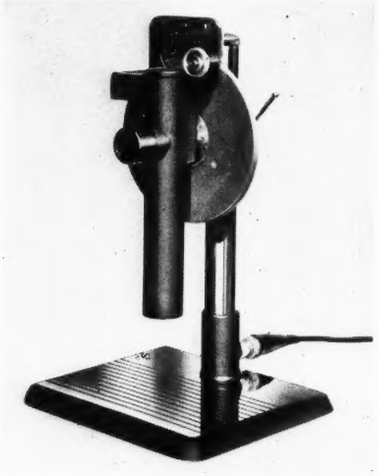
Newman Wheel-Dresser

Emery-wheel dresser brought out by L. Newman, 1001 Twenty-fourth St., Oakland 7, Calif., for dressing any type of grinding wheel. It is made in the style shown, which is designed especially for surface grinding wheels, and in an angle mounted style applicable to cylindrical grinding wheels.



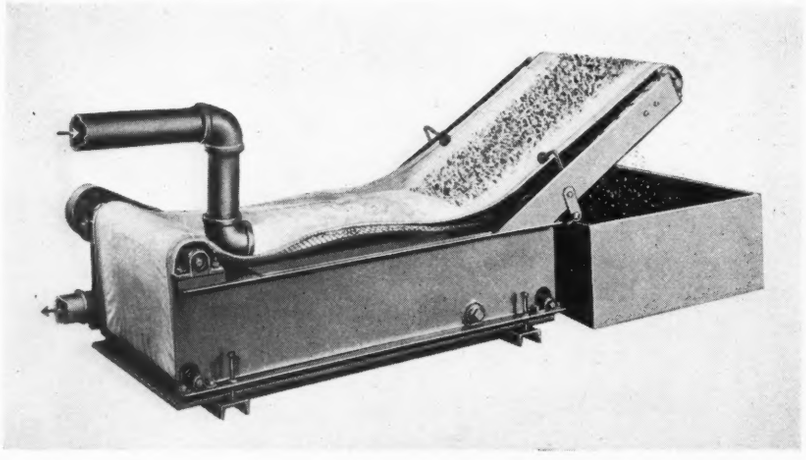
Magnesium Safety Tongs

Light-weight magnesium safety tongs with adjustable handles designed to provide greater ease and flexibility in feeding work to presses and shears. The new tongs can be adjusted instantly to any desired position. They are constructed of specially alloyed magnesium, and are designed to crush if accidentally caught within the die opening, thus preventing damage to the die. Manufactured by Magline, Inc., Pinconning, Mich.



Automatic Web Type Filter

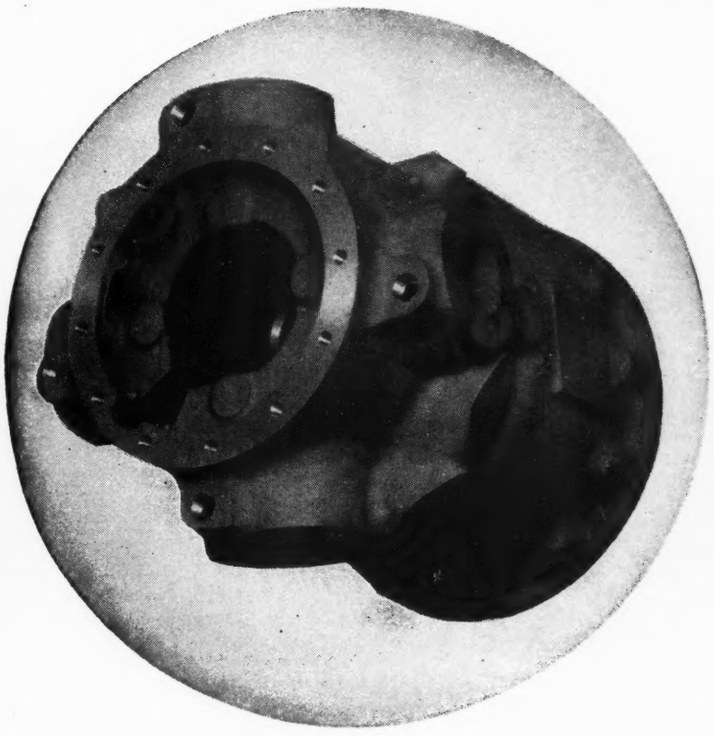
Automatic "Houdaille" web type filter, designed by the Honan-Crane Corporation, 912 Sixth St., Lebanon, Ind. Has a self-cleaning, continuously rotating filter web. Use of the complete filter bed enables this small filter to handle a large volume of coolant. The endless belt utilizes the same filtering medium over and over. Designed to serve individual machine tools or small central coolant systems. It is especially adapted for use with all types of grinders, broaches, drilling, lapping and milling machines, or wherever a mineral or soluble oil coolant is employed. Overall size of the 50 gallon per minute model is only 47 by 42 by 30 inches. This new filter is available in capacities ranging from 40 to 500 gallons per minute.



Goniometer-Collimator for Setting and Checking Angles

Goniometer-collimator introduced by the Safe Flight Instrument Corporation, 4 Water St., White Plains, N. Y., to facilitate fast setting and checking of angles. This instrument is a special type of auto-collimator which can be revolved with reference to a precision graduated circular scale. When the target lines are centered, the device is set at right angles to a reflecting surface. Calibrations are to one half minute of arc, but it is possible to set the device visually to at least ten seconds per arc. The instrument is used for such diverse applications as a variable angle target for setting up optical reference lines; checking flatness of long surfaces, such as lathe beds; and checking parallelism of such surfaces as gage-blocks. It is particularly adaptable for

One a minute-

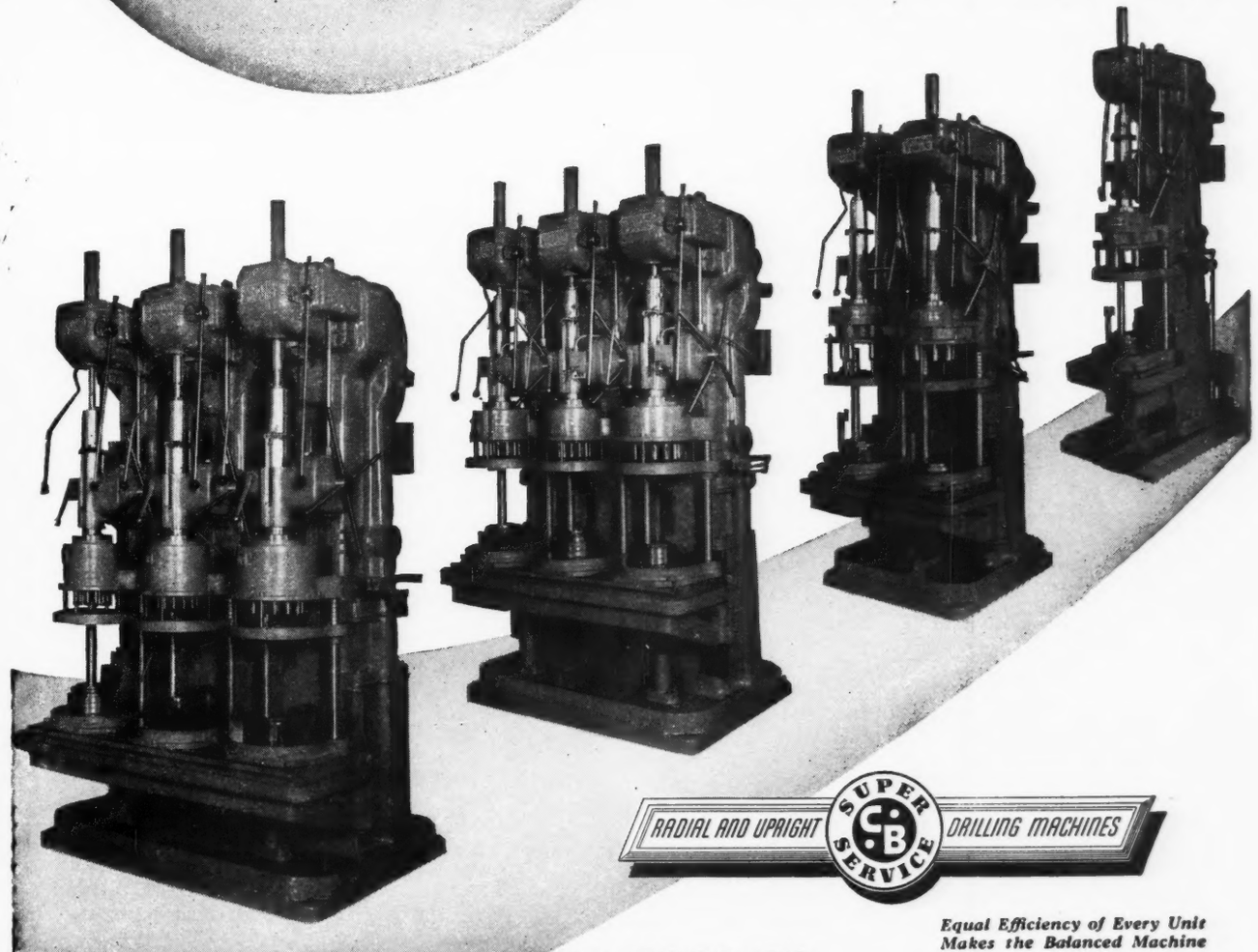


This battery of highly productive 21" and 24" Cincinnati Bickford Super Service Direct Drive Drills is drilling 24—.257" holes; tapping 24—$\frac{5}{16}$" holes; step drilling 4—$\frac{13}{32}$" x $\frac{7}{16}$" diameter holes $1\frac{5}{8}$" deep; tapping 4—$\frac{5}{8}$" holes in this crank case housing.

The operations are performed on both ends of three sizes of castings. All operations are completed at the rate of one a minute.

These Direct Drive Drilling Machines are made in the following sizes: 21" with 3 or 4 horsepower motor; 24" with 5 or $7\frac{1}{2}$ horsepower motor; 28" with $7\frac{1}{2}$ or 10 horsepower motor.

Write for Booklet U-27 for complete description.



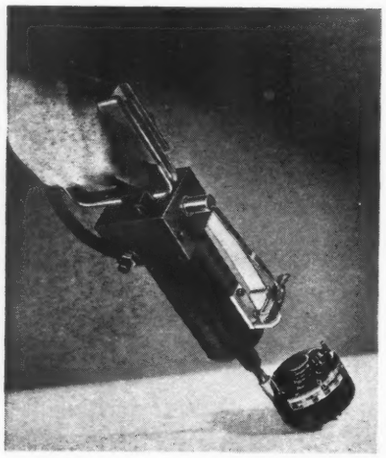
Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. **Cincinnati 9. Ohio U.S.A.**

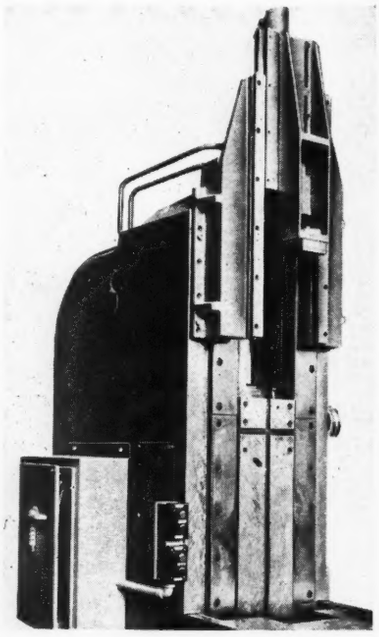
checking small surfaces in inaccessible locations, as, for example, valve seats, milled insert faces, and similar surfaces that are usually difficult to check.

Air-Powered Nut-Runners

Air-powered "Power Torque" nut-runner, designed to give precise torque control in the 0 to 25 inch-pound range. Special gearing is available to extend the torque range of this driver to 40 inch-pounds. This tool is intended for use on production jobs where too much torque would cause breakage or distortion of light metal parts, castings, or plastic. The desired torque is easily set, the built-in torque wrench being used as a gage. The tool is said to be accurate to 2 per cent of torque

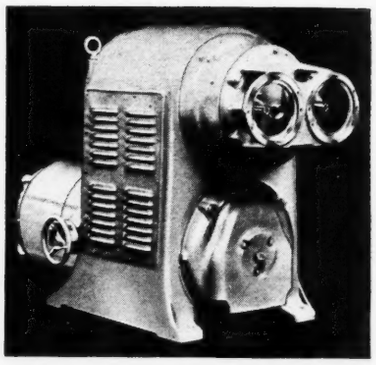


limits, and therefore eliminates the need for hand torque inspections. When the predetermined torque is reached, the tool stops automatically. In the illustration, the tool is shown in use on a typical operation—driving a nut on the housing stud of a small fan motor. Manufactured by Garvin Brothers, Inc., P. O. Box 536, South Bend 24, Ind.



New Type Broach Retriever

T type three-way broaching machine built by the American Broach & Machine Co., Ann Arbor, Mich., which is equipped with a new style broach retriever. Simplified in design and sturdier in construction, the new broach-retrieving unit is said to give improved performance, be more rigid under stress of operation, and provide for easier servicing. It is designed to facilitate handling heavy pull-down broaches.

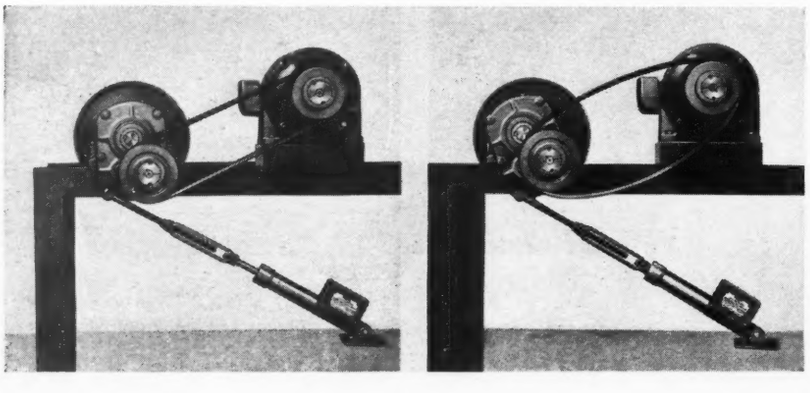


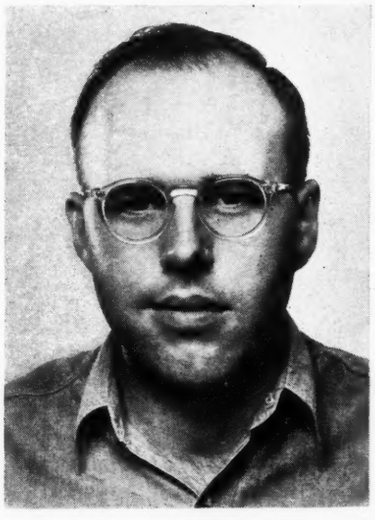
Dual-Head Test Stand

Dual-head test stand developed by U. S. Electrical Motors, Inc., 200 E. Slauson Ave., Los Angeles 54, Calif., to determine the operating characteristics of component parts, such as aircraft generators, vacuum pumps, alternators, magnetos, hydraulic pumps, and compressors. The dual head permits a wider variation in speeds than a single head, and also permits two parts to be tested at one time. The speed of the motor can be instantly changed by merely turning a control dial. The rating is 7 1/2 to 50 H.P. for continuous duty and 10 to 75 H.P. for intermittent duty.

Overload Release for Torque-Arm Speed Reducer

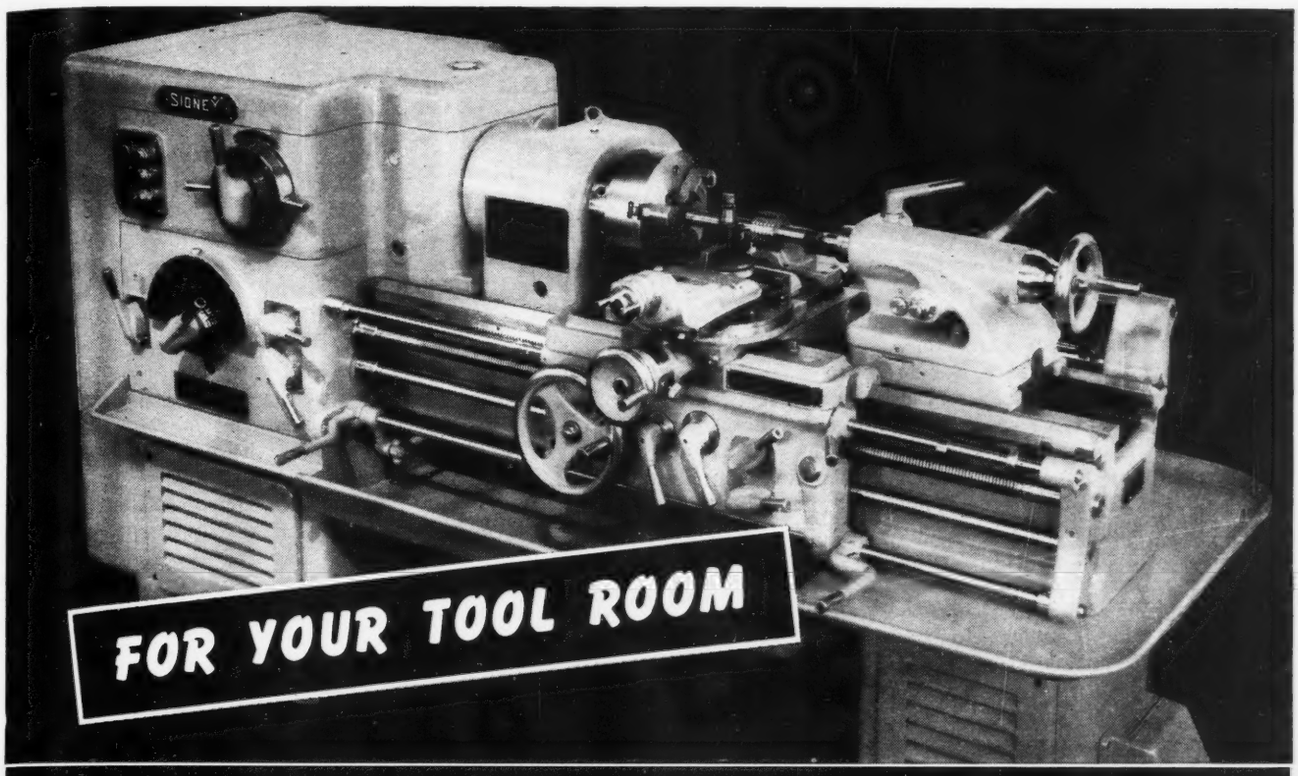
"Tri-Matic" overload release for the torque arm speed reducer made by the Dodge Mfg. Corporation, Mishawaka, Ind. This unit is designed to replace the standard torque arm regularly furnished with the Dodge speed reducer, the two units being interchangeable. The view at the left shows the overload release set with belts tight and speed reducer in operating position. The view at the right shows the device in the tripped position, where the overload pressure has caused the piston of the "Tri-Matic" to plunge lengthwise, loosening the belts, cutting off power, and setting off an alarm signal.





Plastic Safety Lenses

Plastic safety lenses made in an air-conditioned room where the lenses are scientifically "baked" in glass molds are announced by the American Optical Co., Southbridge, Mass. The plastic lenses, only half the weight of their glass counterpart and extraordinarily resistant to breakage, are designed to protect the eyes of industrial workers. Tests have disclosed these lenses to be highly resistant to such eye hazards as sp'ashing chemicals, welding spatter, emery wheel sparks, and the impact of hard, small, high velocity particles. They are also said to be free from fogging under steamy working conditions.



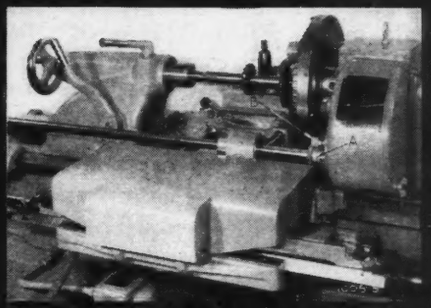
SIDNEY Universal Relieving Attachment

Here is an entirely new development which has many advantages over the conventional relieving attachment.

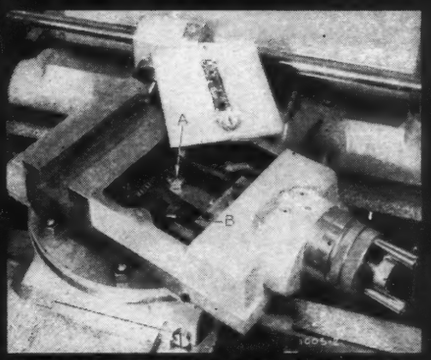
It is adaptable to Sidney Lathes already in the field as well as to new machines and incorporates a 4 to 1 spindle speed reducer integral with the change gear housing thus eliminating the need for 2-speed motors or other costly devices to reduce spindle speed. Universal joints have been eliminated entirely. A timer arrangement enables the operator to pick up any relief at any point with a minimum of effort. A clutch lever is provided to disengage relieving attachment for conventional turning.

This attachment will handle plain external relieving, spiral relieving, form relieving, end relieving and internal relieving.

For complete details write us or contact a Sidney representative.



Rear view showing change gear housing with conveniently located index plate.



Illustrates adjustable cam throw. Additional cams are not required to obtain various throws.

SIDNEY MACHINE TOOL COMPANY • SIDNEY, OHIO

Builders of Precision Machinery Since 1904

Water-Cooled Mold Produces 8000-Pound Metal Slabs

THE world's largest water-cooled slab mold, built by the Machine Division of the Torrington Mfg. Co., has recently been installed in the New Bedford, Mass., plant of Revere Copper & Brass, Inc. Much larger slabs can be cast with this mold than with the designs previously available, so that economies will be effected in the casting and subsequent processing of brass. The huge mold weighs over 40,000 pounds, and stands 8 feet high. The cavity is 50 inches wide, by 8 inches thick by 6 feet high, permitting a Muntz metal slab weighing 8000 pounds to be cast. The mold is so designed that eventually it can be used for casting a slab 10 inches thick and weighing 10,000 pounds.

Muntz metal cast by the new mold is used chiefly for making sheet forms for sheathing, condenser heads, valve stems, and brazing rods and tubes, as well as for architectural work. The high strength and low ductility of Muntz metal, which is approximately 60 per cent copper and 40 per cent zinc, make it especially suitable for these applications. Other types of brass for rolling have been cast in much smaller sized molds. During the last ten years brass has been cast in 1-ton slabs for such defense items as cartridge cases and shell bands.

In addition to size, the outstanding feature of this mold is its intricate cooling system. A honeycomb-shaped compartment, designed to provide maximum cooling, lies behind each of the mold's 3-inch copper plates. As the mold is filled with molten metal, water flows continuously through these compartments at a controlled temperature. Up to 4000 gallons of water per minute passes through the mold and carries heat from the cast bar. The water temperature rises approximately 10 degrees in its passage through the mold.

* * *

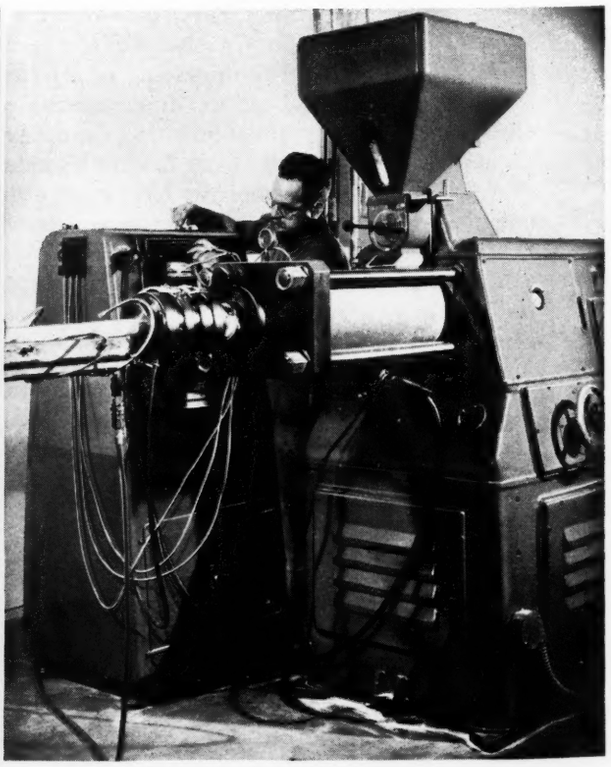
According to the latest figures of the American Gear Manufacturers Association, the volume of business in the gearing industry increased by 35.2 per cent in December, compared with the previous month.

Extruder Press to be Seen at Plastics Show

An extruding press, a fully automatic plastics molding press, and a vacuum metallizing unit will be shown in operation at the Fifth National Plastics Exposition in Philadelphia, Pa., March 11 to 14, by the F. J. Stokes Machine Co., Philadelphia, Pa. The extruder will be compounding and pelletizing material on a production basis for the first time at a public showing.

The Stokes-Windsor RC-200 extruder will make pipe or tubing of many sizes and types, as well as sheet or film up to 54 inches wide by 8 mils thick. With inflation take-off, sheets as thin as 3 mils can be produced. It also compounds colors with the plastic material during the extrusion process. The 15-ton Model 800 plastics molding press is fully automatic, and molds all thermosetting compounds, including alkyds, without modification. This press is simple to adjust and operates at extremely high speed. The Stokes vacuum metallizing unit will produce brilliant metallic or colored finishes on plastics, paper, or low-cost metal parts.

Water-cooled slab mold designed to produce brass slabs weighing up to 10,000 pounds



Stokes Windsor extruder press, to be exhibited at the Plastics Exposition

Between Grinds

By E. S. Salichs

Under the Missile Snow

A snow thrower has been developed for the home owner and small commercial user, with a throwing capacity of about 190 square feet of snow per minute. A rotor mechanism throws the stream of snow as far as 40 feet away in any direction desired. Now all that is needed is for the machine to convert the snow into hard snowballs and Junior will welcome the chance to clean up the whole block.

Destination Wastebasket

A news release from a local advertising agency directed to a concern whose name was similar to ours, reached us in error. Unable to locate this concern, we took the trouble to telephone the agency to ask if we could forward the release for them to the proper address. Upon explaining the matter to a woman there, we were somewhat surprised when, after replying "I'll tell you what to do with it," she lowered her voice and hoarsely whispered into the receiver, "Throw it away."

River Stay Way

The national treasurer of the A.S.T.E. resides on Mad River Road in Dayton. Uses bags of money to brace his house against the onslaught.

Plaudit

Seventy-year-old C. P. Nelson of DuBois, Pa., upon stepping out of the machine business, wrote to tell us why he was not renewing his subscription and ended his letter: "I have read MACHINERY with pleasure and profit for at least twenty-five years." We are sorry to lose such a valued subscriber—but a happy retirement to you, Mr. Nelson!

I Am Mee

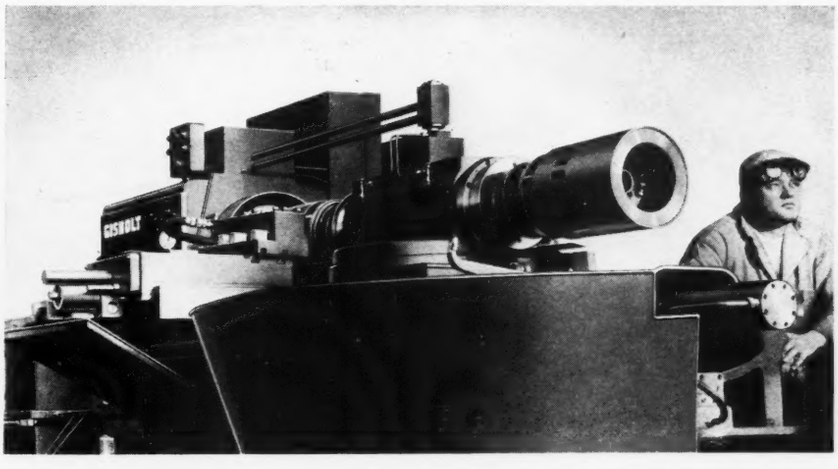
A man sauntered up to a hotel desk where a member of our staff happened to be registering, and asked the clerk, "Is there any mail for Mee?" The clerk naturally replied, "What is your name, sir?"

Frozen in Their Tracks

The new chilled wheels for freight cars undergo eighty-nine tests before placement in service —enough tests to make anything freeze.

Start vs. Stop Clowning

Television is becoming the eyes of management to check on operations in the plant, about 150 industrial systems already functioning around the country. The neighbors can't sit home and watch you work, however—closed circuits.



TAKE AIM, FIRE! With what? The big gun seen here is actually a Gisholt hydraulic automatic lathe used for machining Diesel cylinder liners. As the lathe stood on the test floor prior to shipment, so many comments were being made about its resemblance to a secret weapon, that a photographer decided to take a shot at it

News OF THE INDUSTRY

Victor Mancuso, new executive vice-president and assistant general manager of the Axelson Mfg. Co.

California

VICTOR MANCUSO has been elected to the position of executive vice-president and assistant general manager of the Axelson Mfg. Co., Los Angeles, Calif., lathe manufacturer. Mr. Mancuso started with the company in 1917, and has held the positions of shop superintendent, works manager, and vice-president in charge of manufacturing prior to his current promotion.

C. T. HANSEN & CO., Russ Bldg., San Francisco, Calif., have been appointed West Coast sales representatives for the SAHLIN ENGINEERING CO., Birmingham, Mich., designers and manufacturers of Iron Hand automatic press unloaders and special material-handling devices.

A. MILNE & CO., solid and hollow tool steel distributors of New York City, announce that their San Francisco office has moved to larger quarters, at 540 First St., San Francisco 7, Calif.

Illinois

FOUR STATES MACHINERY CO., a machinery dealer, was recently organized for the purpose of representing several machine tool manufacturers in the Chicago and Milwaukee areas. Officers of the new concern are WALTER MURPHY, chairman; ROBERT HEIDEMANN, president; JOHN LAING, vice-president and treasurer; and JAMES BAILLET, secretary. Also associated with the firm is DAVID ASMUS. Among the manufacturers represented are the Cincinnati Shaper Co., Federal Press Co., Globe Tool & Engineering Co., Kane & Roach, Inc., Kaufman Mfg. Co., Reed-Prentice Corporation, and Webb Corporation. The company has opened offices at 5304 W. Chicago Ave., Chicago 51, Ill.; and 606 W. Wisconsin Ave., Milwaukee 3, Wis.

SMITH & MILLS CO., manufacturer of shapers, has been acquired, from the HAMILTON-THOMAS CORPORATION, by interests represented by A. G. BRYANT, president of the Bryant Machinery & Engineering Co. Executive, sales, and engineering offices of the company have been established at 400 W. Madison St., Chicago 6, Ill. Mr. Bryant becomes president of the Smith & Mills Co., and GEORGE H. MERRIELL, vice-president and general manager.

ROBERT N. NELSON, who earlier this year was appointed assistant sales manager of the Pneumatic Division of Sundstrand Machine Tool Co., Rockford, Ill., has now been advanced to the position of sales manager of the Division.

Robert N. Nelson, new sales manager of the Pneumatic Division of Sundstrand Machine Tool Co.

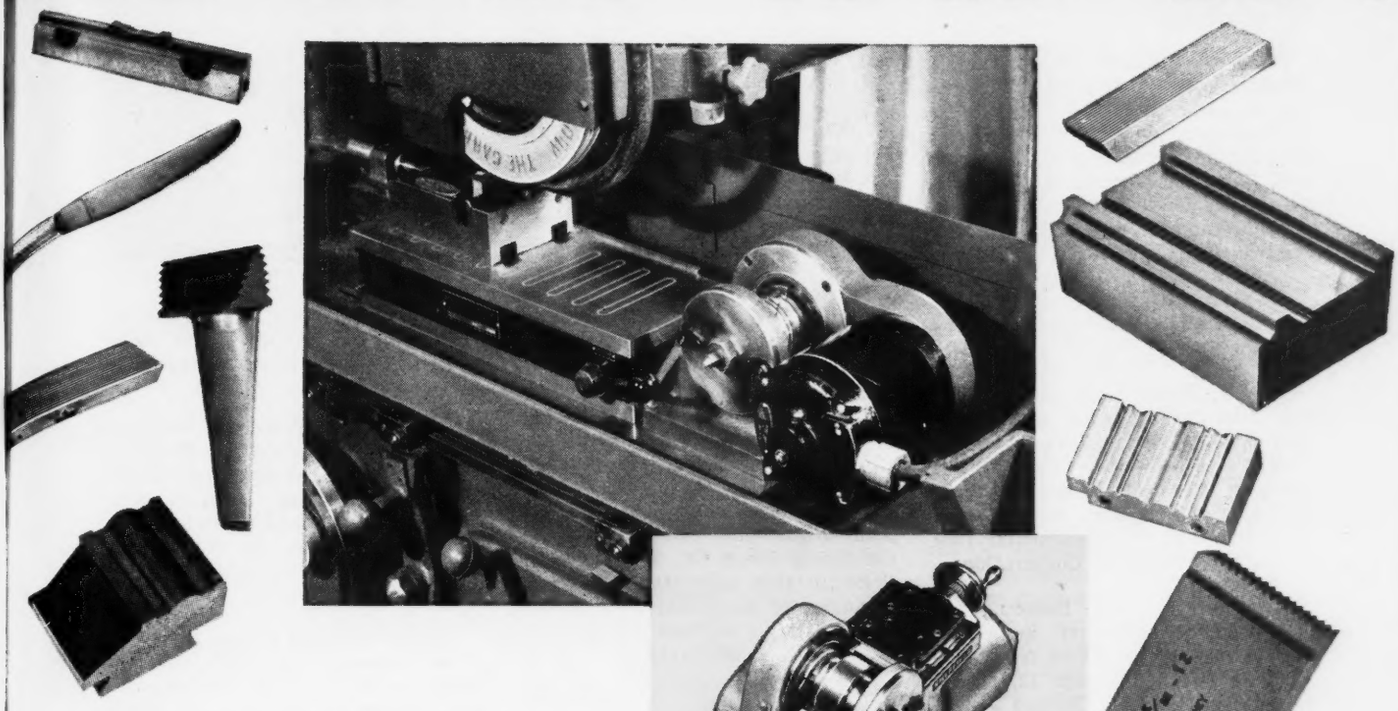
Guy Hubbard, assistant general sales manager of the Bryant Machinery & Engineering Co.

GUY HUBBARD has become associated with the Bryant Machinery & Engineering Co., Chicago, Ill., as assistant general sales manager. His responsibilities will include advertising, publicity, and sales promotional activities. Mr. Hubbard for the last thirteen years has been serving as machine tool editor of "Steel."

OLIN INDUSTRIES, INC., East Alton, Ill., has announced the appointment of general managers of their newly created integrated operating divisions, as follows: M. W. ACKER, a director and vice-president of the company, general manager of the Metals Division, with headquarters at East Alton; W. C. SCHADE, general manager of the Arms and Ammuntion Division, with headquarters at New Haven, Conn.; W. S. ALLEN, general manager of the Electrical Division, with headquarters at New Haven; and N. A. HAMILTON, general manager of the Explosives Division, with headquarters at East Alton. M. F. MEISSNER has been named assistant general manager of the Metals Division.

A. M. JOHNSON has retired as chairman of the board of directors of the Barnes Drill Co., Rockford, Ill., after forty-five years of service with the company. W. M. FAIRBAIRN, who has been president and general manager of the company since 1947,

Equip for Crushtrue Grinding to Speed Production and Cut Costs



You can produce the kind of work shown here faster and more economically with Sheffield Crushtrue Dressing Devices, and Crushtrue Dressing Rolls.

Dressing the grinding wheel by Crushtrue equipment (1) is very much faster than diamond dressing, (2) increases the cutting capacity of the wheel, (3) greatly reduces generated heat in grinding, (4) minimizes the tendency of the wheel to "load up" (5) reduces the actual grinding time as much as 75%.

Idler, Motorized and Self-truing Crushtrue Devices are available. Your selection will depend upon the work you do and the grinding equipment you have.

Crushtrue rolls for standard threads can be shipped immediately from a Sheffield "bank." Rolls for special forms for users engaged in long run production schedules can also be included in this stock on hand. Users send in rolls to be reground and immediately replacements from Sheffield's bank are forwarded at nominal cost. This relieves the user from the expense of ever having to buy new rolls.

Write for information on the Sheffield "Crushtrue Roll Bank" and specifications on these Crushtrue Devices.

5678

the Sheffield corporation

Dayton 1, Ohio, U. S. A.

GAGES • MEASURING INSTRUMENTS • MACHINE TOOLS
CONTRACT SERVICES • THREADING TOOLS

and who has completed forty-three years of service with the Barnes Drill Co., succeeds Mr. Johnson as chairman. REED M. ANDRESS, executive vice-president, has been promoted to the position of president and general manager in Mr. Fairbairn's stead. Mr. Andress has been with the company for thirty-one years. ROGER MARRIOTT, vice-president, has been advanced to the post of executive vice-president.

PRECISION CASTINGS CORPORATION, a subsidiary of the Precision Castings Co., Inc., Syracuse, N. Y., has opened a die-casting plant in Chicago, Ill., covering approximately 60,000 square feet. The plant is completely equipped for the production of aluminum, magnesium, and zinc base alloy die castings, as well as for the building of die-casting dies, tools, jigs, and fixtures. THEODORE H. PICKERING has been appointed works manager of the new plant.

JOHN J. FITZSIMMONS was recently appointed to the sales engineering staff of the Illinois Tool Works, Chicago, Ill., to serve cutting tool users in the Detroit area. Before joining the company, Mr. Fitzsimmons was with the Continental Tool Division of Ex-Cell-O Corporation.

NEFF, KOHLBUSCH & BISSELL, INC., machine tool distributor, announces the removal of its offices from 2400 W. Madison St., Chicago 12, Ill., to 5700 W. North Ave., Chicago 39, Ill. The appointment of F. C. BERGER as sales manager has also been announced.

ARTHUR E. STEHLE has been appointed midwest district manager by the Ettco Tool Co., Inc., Brooklyn, N. Y., manufacturer of Ettco-Emrick drilling and tapping equipment. Mr. Stehle's headquarters will be at the Chicago, Ill., office, 605 W. Washington Blvd.

A. B. HENNESSY, JR., was recently appointed district manager of sales in the Chicago area for the Summerill Tubing Co. Division of Columbia Steel & Shafting Co., Pittsburgh, Pa. The Chicago office is located at 1033 S. Boulevard, Oak Park, Ill.

DALE C. DOTY has been named director of purchases for Skilsaw, Inc., Chicago, Ill., manufacturer of portable power tools. JOHN L. SCHULER will succeed Mr. Doty in his former position as purchasing agent.

ROBERT PICCHIETTI has been appointed purchasing agent for Kling Bros. Engineering Works, Chicago, Ill., manufacturers of heavy-duty machinery, friction saws, shears, etc.

AMERICAN PULLMAX CO. announces its removal to larger quarters at 2455 N. Sheffield Ave., Chicago 14, Ill.

Indiana and Michigan

ANDREW B. STEVENS has been made assistant factory manager of the American Wheelabrator & Equipment Corporation, Mishawaka, Ind., manufacturer of dust collectors and abrasive blasting equipment. He has held the position of supervisor of production control and stores for the past six years.

RAYBESTOS-MANHATTAN, INC., Passaic, N. J., has completed the initial unit of the Wabash Division plant at Crawfordsville, Ind. This new plant is operating exclusively on the production of defense materials.

PHYSICISTS RESEARCH CO., Ann Arbor, Mich., manufacturer of the Profilometer and other measuring instruments, has changed its name to the MICROMETRICAL MFG. CO., and at the same time has changed its mailing address to 345 S. Main St. The development group of the company is now known as the MICROMETRICAL DEVELOPMENT CORPORATION; headquarters of this branch of the business are at 2821 S. State St., Ann Arbor.

E. E. WESSELHOFF has been appointed assistant chief engineer of the Morse Chain Co., Detroit, Mich. Prior to this appointment, he was manager of the company's Boston branch office, a position that will now be filled by H. N. TYLER.

Mississippi and Tennessee

CLAYTON CARL has been appointed superintendent of the West Point, Miss., works of the Babcock & Wilcox Co., New York City. Prior to his transfer to the new plant at West Point which is nearing completion, Mr. Carl was foreman in the sheet and structural shop at the Barberton, Ohio, plant.

LOUIS J. BAUER has been appointed abrasive engineer by the Norton Co., Worcester, Mass., in the territory covering Arkansas, western Tennessee, Mississippi, and Louisiana. His headquarters are at the E. C. Blackstone Co., Memphis, Tenn.

New England

HEWITT-ROBINS, INC., New York City, manufacturer of belt conveyor systems and vibrating machinery, is moving its headquarters office to Stamford, Conn. However, the Eastern Division and export sales office of the Hewitt Rubber, Restfoam and Robins Conveyors Divisions will remain at 370 Lexington Ave., where headquarters had been located, while the Robins Engineers Division will continue at 157 Chambers St., both in New York City.

Photo by Ray Fredericks

Carlton H. Winslow, recently elected vice-president in charge of sales of Cuno Engineering Corporation

CARLTON H. WINSLOW has been elected vice-president in charge of sales of the Cuno Engineering Corporation, Meriden, Conn., manufacturer of filters and electrical automotive equipment. Mr. Winslow has been connected with the firm for eighteen years.

CLAUDE R. MORGAN has joined the Cone Automatic Machine Co., Inc., Windsor, Vt., and will take charge of the company's program of carbide tool development. For a number of years, Mr. Morgan was associated with the General Electric Co., having been superintendent of the bar and chucking machine division at Pittsfield, Mass., where he was actively interested in the research and development of carbide applications to multiple-spindle bar automatics.

Claude R. Morgan, in charge of the program of carbide tool development at the Cone Automatic Machine Co.

Everett M. Hicks, newly elected vice-president and director of the Norton Co.

EVERETT M. HICKS was recently elected vice-president and a director of the Norton Co., Worcester, Mass. He remains manager of the company's Grinding Machine Division as well. FRANK W. SMITH retired from the board of directors, but is still a vice-president in the company and consultant on a new machine tool construction project.

New Jersey

WATSON-STILLMAN, Roselle, N. J., announces the following appointments of executive personnel: A. B. DISS, vice-president in charge of manufacturing; ADOLPH DEMATTEO, chief engineer; R. W. SCHRECK, general manager of sales, Hydraulic Division; JACKSON KEMPER, general manager of sales, Distributor Products Division; HERBERT E. ELLIOTT, sales manager, Hydraulic Division; JOHN P. BITTENBINDER, sales manager, Distributor Products Division; ELSWORTH FALKENBERG, plant manager; ERIC NELSON, plant superintendent; and A. WALTERS, production manager, Hydraulic Division.

HERMAN H. MILLER retired recently after serving fifty years with the Worthington Pump & Machinery Corporation, Harrison, N. J. Mr. Miller was active in the development of compressors, and in 1932 became manager of the corporation's Compressor Division. He also traveled throughout the United States supervising installations of compressors, and wrote articles on the subject of compressor applications.

INDUSTRIAL SYSTEMS Co., New Brunswick, N. J., has been appointed exclusive distributor for the complete line of washing and metal treating machines manufactured by the INDUSTRIAL WASHING MACHINE CORPORATION, also of New Brunswick.

New York

WILLIAM B. SHERMAN has been named sales manager of the Wahlstrom Float-Lock sales department in the General Products division of the American Machine & Foundry Co., New York City. He was formerly assistant manager of the company's Commercial Research and Development department. CHARLES WIEDMANN, previously sales manager of Wahlstrom chucks and tapper attachments, will serve as assistant to Mr. Sherman.

JAMES A. NELSON has joined the American Machine & Foundry Co., New York City, as manufacturing assistant to the vice-president and

James A. Nelson, manufacturing assistant to vice-president and general manager of General Products Division, American Machine & Foundry Co.

general manager of the General Products Division. In his new post, Mr. Nelson will supervise manufacturing operations of several AMF subsidiaries, including DeWalt Inc., Lancaster, Pa.; Cleveland Welding Co., Cleveland, Ohio; Sterling Engineering Co., Laconia, N. H.; and the Float-Lock Corporation, Bloomfield, N. J.

ROBERT I. HICKS has been elevated to the post of president and general manager of the Lamson Corporation, Syracuse, N. Y., while CARL F. DIETZ, who had held that position since 1938, continues as president and general manager of the parent company, the Lamson Corporation of Delaware and of its mail tube subsidiaries. FRANCIS D. WEEKS, while continuing as vice-president and treasurer of the Lamson Corporation, has become chairman of the board. In assuming the presidency, Mr. Hicks leaves his position of vice-president in charge of sales; ROBERT B. COLEMAN has been appointed to the newly-created position of manager of sales operations and will be responsible for the corporation's sales policy, plans, and field programs. Mr. Coleman, prior to this appointment, had been eastern regional manager of the Wilson Instrument Division and the Campbell Machine Division of the American Chain & Cable Corporation.

KURT ORBAN Co., INC., has moved its office to 205 E. 42nd St., New York 17, N. Y. The company was recently appointed sole U. S. distributor for the complete line of high-speed shapers manufactured by Klopp-Werke GmbH, of West Germany. The company is also American distributor for the Stahlunion Export GmbH, German steel exporter, and many German machine tool builders, as well as representing a number of German steel and aluminum producers in this country.

CLINTON F. ROBINSON has been elected president and a director of the Carborundum Co., Niagara Falls, N. Y., succeeding H. K. CLARK, who has resigned as president, but will continue to serve as a member of the board of directors. Mr. Robinson was graduated from West Point in 1924, and later acquired an engineering degree from Cornell College. In 1948, he retired as major general from the U. S. Corps of Engineers. He also has had extensive experience in the industrial field, at the time of his appointment being director and member of the executive committee of the Fansteel Metallurgical Corporation, Chicago, Ill., and of the R. P. Bennett Co., Frederick, Md., as well as

Clinton F. Robinson, newly elected president of the Carborundum Co.

a director of the American Metallic Corporation, Portland, Ore. The company has also announced the appointments of the following as vice-presidents: PAUL B. BROWN, Bonded Products and Grain Division; CLARENCE E. HAWKE, Refractories Division; and WILLIAM H. WENDEL, Coated Products Division.

J. LESLIE LENTON, factory manager of the Buffalo plant of the American Machine & Foundry Co., New York City, was recently presented with the AMF Merit Award. The Award was set up six years ago by the company as the highest honor to be conferred upon employes who make exceptional contributions to the growth and welfare of the company. Mr. Lenton was the sixth employe to receive the Award.

JESSE A. GARDENIER, production manager of the Large Motor and Generator Department of the General Electric Co., Schenectady, N. Y., retired recently after serving more than fifty years with the company. Mr. Gardenier began as an office boy in the Switchgear Department in November, 1901, and advanced through many production positions until becoming production manager in 1937.

U. & S., INC., Syracuse, N. Y., has been made sales representative in central and eastern New York State for "Amerigear" and "American" couplings manufactured by the AMERICAN FLEXIBLE COUPLING CO., Erie, Pa.

CARL HIRSCHMANN CO., Manhasset, N. Y., has been appointed representative in the United States to handle Nassovia machines made in Germany for the manufacture of dies, molds, and other three-dimensional forming tools.

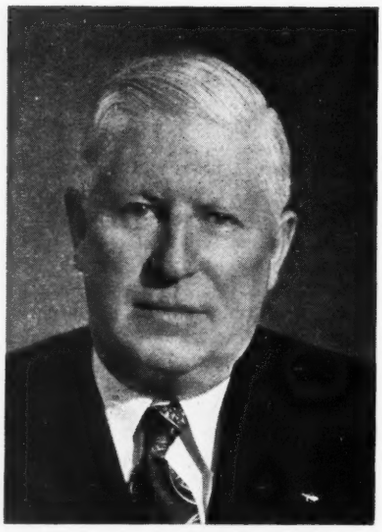
A. GILBERT FORMEL has become associated with Loewy Construction Co., Inc., a subsidiary of Hydropress, Inc., New York City, as projects manager for heavy hydraulic presses, die forging, and extrusion plants.

HENRY N. SHOIKET has become associated with Sam Tour & Co., New York City, in the capacity of head of the mechanical engineering department of the company.

HYDRA-POWER CORPORATION, New Rochelle, N. Y., has moved to 76 Midland Place, Tuckahoe, N. Y.

Ohio

J. H. TREDINNICK has been named executive vice-president of the E. W. Bliss Co., Canton, Ohio. Mr. Tredinnick will have his headquarters in Canton; he was formerly located at Hastings, Mich., where he was vice-president in charge of the Hastings Division. ROBERT SHANNON, who was assistant manager there, has been promoted to manager.



J. H. Tredinnick, new executive vice-president of the E. W. Bliss Co.

Arthur H. Rice, recently appointed vice-president in charge of production of G. A. Gray Co.

JOHN W. BRIGHAM, assistant sales manager of Baker Brothers, Inc., Toledo, Ohio, manufacturer of drilling, boring, tapping, and keyseating machines, has been promoted to the position of general sales manager. Mr. Brigham has been with the company since 1925. JOHN P. NUGENT is filling the position of assistant sales manager. Prior to this appointment, he had been a sales engineer in the company's sales department, serving the Detroit area.

E. W. BLISS CO., Canton, Ohio, announced recently that Bliss presses in western Michigan, except Berrien and Cass Counties, will now be handled directly by the company. WILLIAM CARLSON, sales engineer, will represent the company in western Michigan; his headquarters will be at the Bliss plant in Hastings, Mich. Berrien and Cass Counties will henceforth be serviced by the company's Chicago office.

LODGE & SHIPLEY CO., Cincinnati, Ohio, lathe manufacturer, has begun the construction of a new administration building, which will provide 33,000 square feet of additional floor space. The building will accommodate administrative personnel, the engineering staff, and various departments, such as tool design, time study, and methods and standards.

JOHN A. BORMAN has been appointed chief engineer of the Baker-Raulang Co., Cleveland, Ohio, where he will have charge of new development work and production engineering for the company.

ARTHUR H. RICE has been appointed vice-president in charge of production of the G. A. Gray Co., Cincinnati, Ohio. Mr. Rice was formerly associated with the Miehle Printing Press & Mfg. Co.

WILLIAM H. TAYLOR has been appointed general sales manager of Tinnerman Products, Inc., Cleveland, Ohio, manufacturer of fasteners. Prior to this appointment, Mr. Taylor had served as director of engineering and assistant to the vice-president of the company.

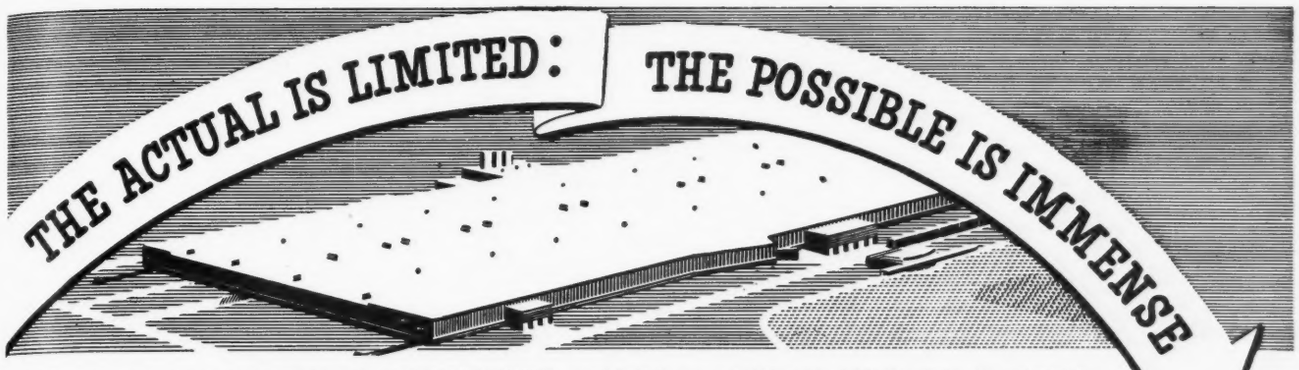
THOMAS T. PHIPPS has been appointed sales engineer in the Cleveland territory for the Surface Combustion Corporation, Toledo, Ohio. In this capacity he will handle all lines of Surface standard industrial furnace and burner equipment.

GERALD F. SINDELAR has joined the Variety Machine & Stamping Co., Cleveland, Ohio, in the capacity of sales manager. Prior to his new connection, Mr. Sindelar had been manager of appliance sales for the Tinnerman Products Co.

GEORGE J. MUNTEAN has been promoted to the position of assistant superintendent of the Canton Bearing factory by the Timken Roller Bearing Co., Canton, Ohio. Mr. Muntean has been with the company for nineteen years.

DAVE WALLACE has been made assistant sales manager of the Cincinnati Lathe & Tool Co., Cincinnati, Ohio. Mr. Wallace had been representing the concern in the Central States, with headquarters in Chicago.

WALTER L. LONGNECKER was recently named general superintendent



NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

© LE Co. 1952

PROPER DESIGN IN WELDED STEEL IMPROVES PRODUCT . . . cuts costs for Hanson-Van Winkle-Munning

THE examples show how one prominent manufacturer has improved the quality of his products while cutting costs by converting to welded steel design.

When designing for efficient welded steel construction, savings in initial material cost alone generally average 85% to 95%. This is because steel costs less per pound. And with steel's greater strength and rigidity, fewer pounds of metal are needed. In many cases, machining operations required for iron can be minimized or eliminated entirely.

Where product designs utilize the economies of welded steel, cost analyses show that:

1. Material costs for steel generally range from 5% to 15% as compared with castings.

2. Labor costs for fabricating steel are about 30% of initial casting purchase costs.

3. Welding costs average 50% of total labor costs for fabricating steel.

If your costs do not approximate these averages, your product designs should be reappraised. A Lincoln Welding Engineer will gladly point out what benefits of welded steel may have been overlooked.

Inquire about the "Weldesign Training Course" for your engineers, designers and production men.

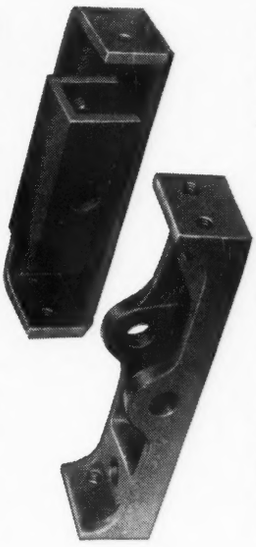


Fig. 3. Welded steel *saves 30% cost . . . cuts weight 50%. Design is simpler . . . plain channel replaces complicated casting.*

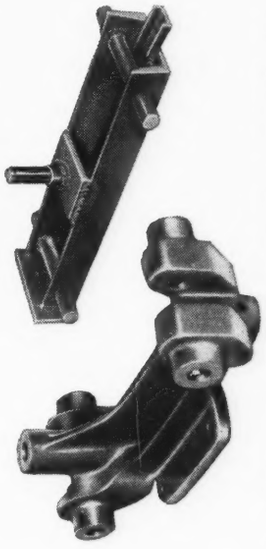


Fig. 4. Stronger, more rugged machine part *results when fabricated from steel strip and standard channel. Weight is cut from 3 lbs. to 2 lbs. 4 oz. Cost of this small part is 12% less.*

ORIGINAL CONSTRUCTION

Fig. 1. Machine bracket *for* **Hanson-Van Winkle-Munning,** *Matawan, N.J. weighed 50% more than present steel design. Casting had to be left heavy for strength in hub and arm. Design made efficient use of cast iron by providing cored slots. Casting required milling and drilling.*

PRESENT WELDED STEEL DESIGN

Fig. 2. Finished weldment *costs 25% less . . . eliminates former breakage experienced in casting. Steel hub, cut from bar stock and pre-drilled, is welded to simple formed steel arm in which holes are pre-punched.*

MORE SAVINGS

Machine Design Sheets are available to designers and engineers. Write on your letterhead to Dept. 23,

THE LINCOLN ELECTRIC COMPANY

CLEVELAND 17, OHIO

The World's Largest Manufacturer of Arc Welding Equipment.

of the Cuyahoga Works of the American Steel & Wire Division of U. S. Steel Co. The location of the Cuyahoga Works is Cleveland, Ohio.

RALPH HANES, methods engineer with the Leece-Neville Co., Cleveland, Ohio, manufacturer of automotive electrical equipment, has been promoted to the position of machine shop superintendent.

J. R. BAREFOOT, JR., manager of operations of the Federal Machine & Welder Co., Warren, Ohio, has been elected president of the Resistance Welder Manufacturers Association for the current year.

LEON F. MILLER, vice-president in charge of sales and engineering of the Machine Division of the Osborn Mfg. Co., Cleveland, Ohio, has been

Leon F. Miller, newly elected director of the Osborn Mfg. Co.

elected a director of the company. Mr. Miller has been with the Osborn Mfg. Co. for twenty-three years, and in 1950 became vice-president.

Pennsylvania and Washington, D. C.

JAMES P. GROWDON, chief hydraulic engineer for the Aluminum Co. of America, Pittsburgh, Pa., since 1938, has become an engineering consultant on hydraulic and related engineering problems for the company. B. J. FLETCHER, who was assistant chief hydraulic engineer, has been promoted to chief hydraulic engineer, in Mr. Growdon's stead.

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa., has changed the name of its sintered carbide production and sales units from Carbide Alloys Division to Carmet Division.

PRATT & WHITNEY DIVISION NILES-BEMENT-POND CO., West Hartford, Conn., has announced that its Pittsburgh branch moved into new quarters at 683 Lincoln Ave., Pittsburgh 2, Pa., which provide better facilities for handling not only Pittsburgh area sales, but also the stocking of cutting tools and gages. Sales of automatic turret lathes made by the Potter & Johnston Co., a subsidiary, are being handled from the new location as well. W. W. STONER, JR., is district manager of the branch.

D. C. WEISS has been appointed sales representative for the Niles Tool Works Co. Division of Baldwin-Lima-Hamilton Corporation, in western Pennsylvania, eastern Ohio, and West Virginia. His headquarters will be in the corporation's Pittsburgh office. Niles tools were formerly handled in the Pittsburgh area by the MacBeth Machinery Co.

HARRY J. CONLAN, assistant division engineer of the Eastern Sales Division, Hyatt Bearings Division of General Motors Corporation, Harrison, N. J., has been transferred to the Pittsburgh office. He will hold a similar position in the Central Sales Division to that which he formerly occupied.

ROCKWELL MFG. CO., Pittsburgh, Pa., has acquired the DELUXE SAW & TOOL CO., Chicago, Ill., and the KARBIDE KING TOOL CORPORATION, High Point, N. C. A. G. FELDMAN, one of the founders of the DeLuxe Saw & Tool Co., will supervise the Chicago plant, while CLAUD T. MILLER will manage the High Point plant.

HOWARD D. TURNER, assistant superintendent of the inspection department of Lukens Steel Co., Coatesville, Pa., has been promoted to the position of superintendent of the Lukenweld Division, in place of E. RAYMOND MCCLUNG who resigned.

FRED W. RICHARDSON has been made general superintendent of the Pittsburgh plant of the Heppenstall Co., succeeding PAUL H. DALEY, who was recently named general manager of the Eddystone plant of the company.

SELAS CORPORATION OF AMERICA, Philadelphia, Pa., a heat-processing engineering concern, announces the opening of a Pittsburgh office at 3829 Willow Ave. under the direction of JOHN L. WILSON.

A. H. STROMEIER has been appointed sales engineer for the Tubular Division of the Aetna-Standard Engineering Co., Pittsburgh, Pa.

WILLIAM A. FITZGERALD has been named assistant sales manager by H. Kramer & Co., Chicago, Ill., of the company's Ajax Metal Division in Philadelphia, Pa.

J. J. DEMUTH, president of the American Society of Tool Engineers, was recently appointed by the National Production Authority to serve as chief of the Tool, Die, Jig, and Fixture Section, Metal-Working Equipment Division, in Washington, D. C.

Texas

Cleco Division of the REED ROLLER BIT CO., Houston, Tex., has appointed the following companies as distributors of Cleco products: GEORGE W. CASSADY CO., Sylvan Dell Road, Williamsport, Pa.; DAVENPORT ENGINEERING CO., 415 W. Third St., Davenport, Iowa; and MONOGRAM AIR & POWER EQUIPMENT, INC., 125 Olive St., New Haven, Conn.

THOMAS L. BLOSE has joined the A. O. Smith Corporation of Texas, Houston, Tex., as chief engineer at the company's Houston pipe mill. He previously was employed at the Spang-Chalfant seamless tube mill, Ambridge, Pa.

HAROLD B. RIDGLEY, formerly assistant superintendent, has been promoted to tooling superintendent of the Texas Engineering & Mfg. Co., Inc., Dallas, Tex.

Wisconsin and Minnesota

GIDDINGS & LEWIS MACHINE TOOL CO., Fond du Lac, Wis., has acquired a new plant in Fond du Lac to house the Davis Boring Tool Division of the company. This plant, which became necessary because of the heavy demands made upon the company by the defense program, will provide 30,000 additional square feet of floor space.

C. W. THOMPSON has been appointed vice-president and treasurer of the Gardner Machine Co., Beloit, Wis. Also announced is the appointment of R. E. PRICE as assistant general manager of the company. Mr. Price was formerly assistant to the president of the Landis Tool Co.

JAMES H. LAHEY has been appointed to the newly created post of assistant sales manager of the Oil Hydraulics Division of the Webster Electric Co., Racine, Wis.

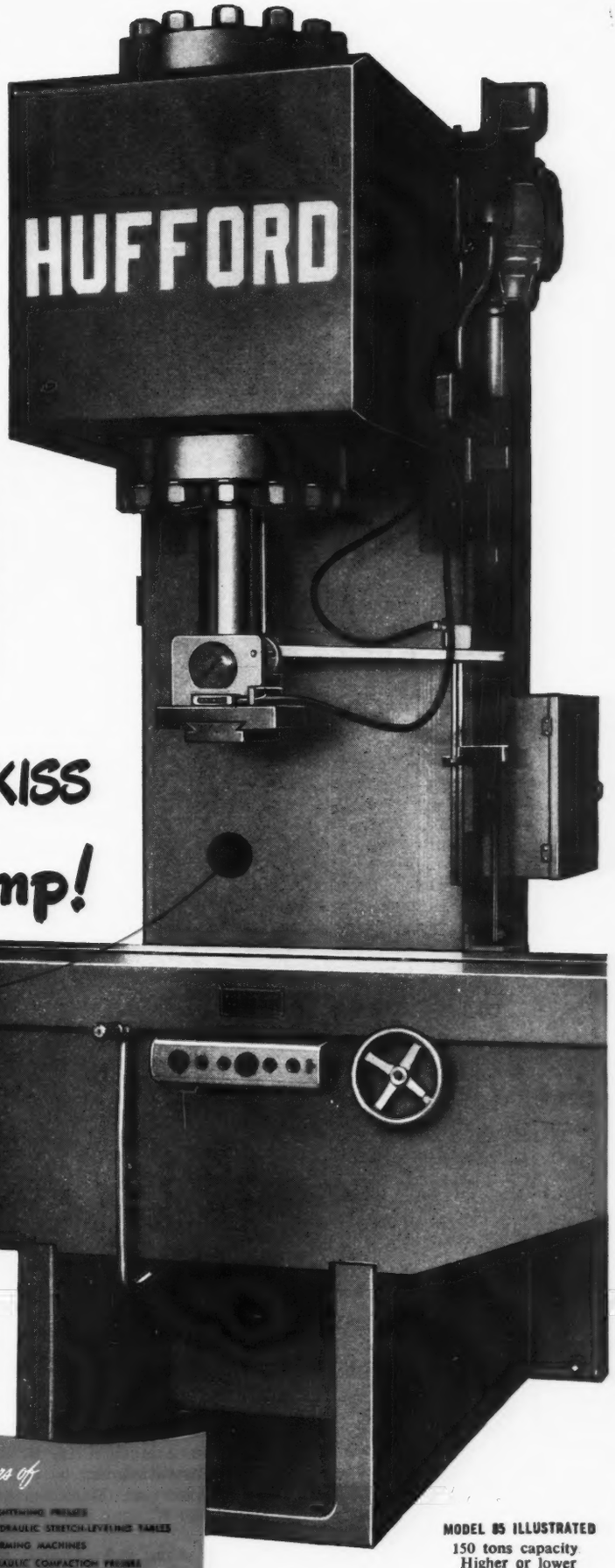
A. C. PAULSON has been made manager of the St. Paul Branch of the Crucible Steel Co. of America, New York City. Prior to this appointment, Mr. Paulson was district representative in Rockford, Ill.

S. L. JOHNSON has been appointed manager of the New Methods Development Division of the "3M" Coated Abrasives Division, Minnesota Mining & Mfg. Co., St. Paul, Minn.

HUFFORD

precision-hydraulic STRAIGHTENING PRESS

For extremely delicate straightening jobs where high tonnage is required you need this new Hufford! Automatic stroke limiter overcomes risk of over-bending. Simply pre-set each stroke for any ram advance—from a few thousandths to full capacity. *Ram automatically halts* at desired extension and repeats with unusual accuracy! *Here's a new degree of control that saves time, saves rejects, saves dollars!* Write for circular today!



...from a feather-soft KISS to a 150 Ton Bump!

ATTACHMENTS:

Motor-driven stop permits almost instant stroke adjustment; final micrometer settings by handwheel. Dial gauge indicates applied force from 0 to 150 tons. Automatic counter shows ram position within .010" from starting position.

MODEL 85 ILLUSTRATED
150 tons capacity
Higher or lower tonnages available.

HUFFORD
Machine Works Inc.
EL SEGUNDO, CALIFORNIA

Manufacturers of

PRECISION HYDRAULIC STRAIGHTENING PRESSES
HYDRAULIC METAL FORMING BULLDOZERS • HYDRAULIC STRETCH-LEVELING TABLES
HYDRAULIC STRETCH-WRAP FORMING MACHINES
PORTABLE HYDRAULIC ELEVATORS • HYDRAULIC COMPACTION PRESSES
CUSTOM-MADE HYDRAULIC MACHINE TOOLS AND ACCESSORIES

Obituaries

William H. Oldacre

William H. Oldacre, president and general manager of the D. A. Stuart Oil Co., Ltd., Chicago, Ill., died on January 18. After graduation from Hiram College, Mr. Oldacre obtained shop and engineering experience with the General Electric Co. and the Timken Roller Bearing Co. He then joined the D. A. Stuart Oil Co., with which company he was associated for almost thirty-two years, holding the position of director of research before becoming president. Because of the specialized interests of the company, he gave much attention through the years to metal-cutting and to sulphurized and sulpho-chlorinated oils and greases. He published many papers on the subjects of cutting fluids and metal-working problems.

Mr. Oldacre was active in a large number of engineering and technical societies, including the American Society of Mechanical Engineers, Society of Automotive Engineers, American Petroleum Institute, and the National Lubricating Grease Institute, of which latter Institute he had been national president.

Morris E. Leeds

Morris E. Leeds, founder and chairman of the board of directors of Leeds & Northrup Co., Philadelphia, Pa., died on February 8 at Lake Wales, Fla., at the age of eighty-two years, after an illness of several weeks. Mr. Leeds was honored by many organizations during his lifetime for his achievements in industry; he was the recipient of the Edison Medal of the American Institute of Electrical Engineers for the development and production of instruments and controls, and of the Edward Longstreth Medal of the Franklin Institute for the invention of the instrument known later as the Leeds Recorder, which was the first balance-method industrial recording instrument. His work in industrial relations was also recognized.

Mr. Leeds belonged to a number of organizations, among them the American Institute of Electrical Engineers, the American Society for Testing Materials, and the American Society for Metals.

OTIS L. SMITH, president of Weldit, Inc., Detroit, Mich., died on January 28, after collapsing from a heart attack while at his desk. Mr. Smith was a welding pioneer, having spent over thirty-five years in the industry. His original company was the Weldit Acetylene Co., established in 1918 in Detroit. There he built a new plant in 1946, where the company, now known as Weldit, Inc., is devoted to the manufacture of welding equipment. Mr. Smith developed many welding products, including the Weldimatic torch and Weldit Gasaver.

HERBERT A. STROM, chief designing engineer of the Weinman Pump Mfg. Co., Columbus, Ohio, died on January 20 at the age of sixty-eight years. Mr. Strom was associated with the company from 1935 until the time of his death. Practically his entire career was devoted to the design of pumping machinery, and he was directly responsible for the design of many pumps that have won wide acceptance throughout industry.

Coming Events

MARCH 17-21—Ninth Biennial Industrial Exposition of the AMERICAN SOCIETY OF TOOL ENGINEERS at the International Amphitheatre, Chicago, Ill. Harry E. Conrad, executive secretary, 10700 Puritan Ave., Detroit 21, Mich.

MARCH 22-APRIL 6—Second CHICAGO INTERNATIONAL TRADE FAIR at the Navy Pier, Chicago, Ill. For further information, write to Executive Vice-president John N. Gage, Colonel U. S. A. (Ret.), Merchandise Mart, Chicago 54, Ill.

APRIL 1-4—Twenty-first annual conference on packaging, packing, and shipping and NATIONAL PACKAGING EXPOSITION at the Public Auditorium in Atlantic City, N. J. Further information can be obtained from the American Management Association, 330 W. 42nd St., New York City.

APRIL 7-9—Annual meeting of the AMERICAN SOCIETY OF LUBRICATION ENGINEERS at the Statler Hotel, Cleveland, Ohio. National secretary, W. F. Leonard, 343 S. Dearborn St., Chicago 4, Ill.

APRIL 17-18—Spring meeting of the AMERICAN MACHINE TOOL DISTRIBUTORS' ASSOCIATION at the Edgewater Beach Hotel in Chicago, Ill. Executive secretary, Thomas A. Fernley, Jr., 1900 Arch St., Philadelphia 3, Pa.

APRIL 29-30—Eighth annual meeting of the METAL POWDER ASSOCIATION and METAL POWDER SHOW at the Drake Hotel, Chicago, Ill. Headquarters of the Association, 420 Lexington Ave., New York 17, N. Y.

MAY 1-7 — International Foundry Congress and Show at Convention Hall, Atlantic City, N. J. Sponsored by the AMERICAN FOUNDRYMEN'S SOCIETY, 616 S. Michigan Ave., Chicago 5, Ill.

MAY 5-16—BRITISH INDUSTRIES FAIR at London and Birmingham, England. For further information, write to British Information Services, 30 Rockefeller Plaza, New York 20.

MAY 22-24 — Sixth annual convention of the AMERICAN SOCIETY FOR QUALITY CONTROL at the Onondaga County War Memorial, Syracuse, N. Y. Further information can be obtained from the Society, Room 5036, 70 E. 45th St., New York 17.

JUNE 2-4—Annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION at the Homestead, Hot Springs, Va. Executive secretary, John C. Sears, Empire Bldg., Pittsburgh 22, Pa.

JUNE 9-21 — Triennial meeting of the INTERNATIONAL ORGANIZATION FOR STANDARDIZATION at Columbia University, New York City. JUNE 11-14, meeting of the Screw Threads Committee of the I.O.S. For further information, write to the American Standards Association, 70 E. 45th St., New York 17, N. Y.

JUNE 23-27 — Fiftieth anniversary meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Hotels Statler and New Yorker in New York City. Further information can be obtained from the executive secretary, C. L. Warwick, 1916 Race St., Philadelphia 3, Pa.

SEPTEMBER 8-10 — THIRD NATIONAL STANDARDIZATION CONFERENCE sponsored by the American Standards Association in Chicago, Ill. Headquarters, Museum of Science and Industry. Further information can be obtained from the Association, 70 E. 45th St., New York 17, N. Y.

NOVEMBER 19—Thirty-fourth annual meeting of the AMERICAN STANDARDS ASSOCIATION at the Waldorf-Astoria in New York. Headquarters of Association, 70 E. 45th St., New York City.